

634.905
IF
V.42

INDIAN FORESTER

JULY, 1916.

ACKNOWLEDGMENT OF MR. MERCER'S SERVICES AS EDITOR OF THE *INDIAN FORESTER*.

In response to suggestions received we take this opportunity to record a hearty vote of thanks to Mr. Mercer for his very successful management of the *Indian Forester* for five years. In so doing we feel confident we are doing no more than expressing the sentiments of all members of the Indian Forest Service.

CHIEF FACTORS INFLUENCING THE DEVELOPMENT OF SAL SEEDLINGS.

BY R. S. HOLE, I.F.S., FOREST BOTANIST.

(*Paper read before the Board of Forestry at Dehra Dun,
March 28th, 1916.*)

1. In the case of research work extending over a series of years and comprising a large number of separate experiments, it is desirable to summarise the results from time to time and to briefly review the work as a whole. The various results can then be

seen in their proper perspective and the bearing of the work, as a whole, on the problems of practical forestry, appreciated. From past experience, also, it is believed that a short review of this kind will be acceptable to the members of the Board of Forestry who visit us but once in three years and who, therefore, can personally see only a small part of our experimental work at Dehra. The present paper consequently contains a summary of some of the chief results of the work recently carried out at Dehra Dun on the factors influencing the development of Sal (*Shorea robusta*) seedlings.

2. The seedling reproduction of *sal* in our Indian forests is by no means satisfactory. In many forests where conditions seem favourable no seedlings exist and in others the seedlings die back for several years. Fig. 1 (Plate 23) shows examples of *sal* seedlings which have died back for several years and which are typical of the majority of those found in the protected forests of N. India. Note the thickened root-stocks and comparatively feeble shoot development. This dying-back is usually considered to be due to drought. In such cases the whole plant dies annually, with the exception of the stout portion just below the ground-level which persists and gradually increases in size and length until, finally, a persistent aerial shoot is also developed. This delay in the establishment of seedlings interferes with the economic management of our forests and entails a financial sacrifice in the loss of several years' increment. Drought, however, obviously cannot explain why seedlings frequently die wholesale during the rains nor why the dying-back is frequently more marked in shady forest than in more exposed situations in the open.

3. The following results dealing with the causes of the death and dying-back of *sal* seedlings have now been established by work recently carried out at Dehra Dun :—

- (a) Seedlings grown under favourable conditions of soil and moisture in the Dehra Dun garden do not, as a rule, die back. A few weakly individuals do die back, but the majority produce vigorous shoots which persist from the first and attain an average height of



Fig. 1.



Fig. 2.

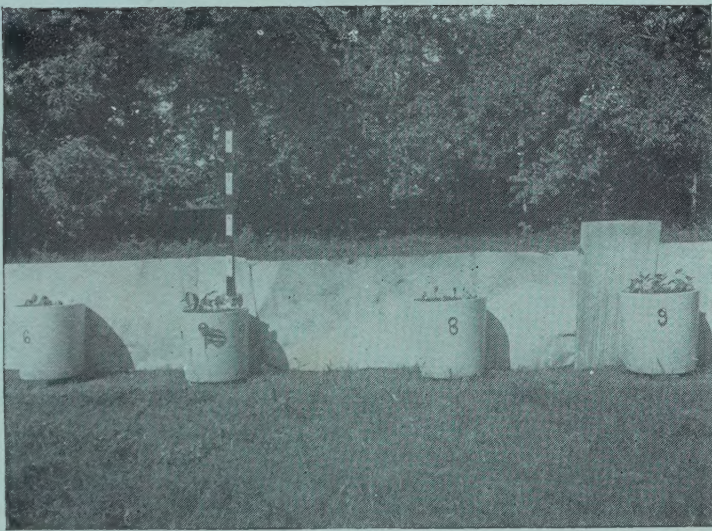


Fig. 3.



Fig. 4.

- Fig. 1. *Sal* seedlings typical of those found in the protected Dehra Dun Forests. These have greatly thickened rootstocks and have died back for several years. The measuring staff appearing in this and the subsequent figures shows lengths of 6 inches, alternately black and white.
- Fig. 2. *Sal* seedlings, 1-year-old, grown under favourable conditions of soil and moisture in Dehra Dun Experimental Garden. The 5 small plants have died back. The majority of the plants, however, do not die back under these conditions and the 4 large specimens are typical of these. Such vigorous plants attain an average height of 13.6 inches in 1 year and 26 inches in 2 years. This may be regarded as the ideal seedling development possible in this locality.
- Fig. 3. Photograph taken September 20th, 1915, showing 1-year-old *sal* seedlings growing in *sal*-forest loam. Note the healthy growth in the uncorked pots 7 and 9, as compared with that in pots 6 and 8 which were corked on July 30th, 1915.
- Fig. 4. Photograph of shade plot XI taken on July 20th, 1915, 2 years after sowing. Note the absence of vigorous seedlings in the seed-bed.

13 inches in one year and 26 inches in two years. Fig. 2 (Plate 23) shows such seedlings 1-year old and also some weakly plants of the same age which have died back. These vigorous garden plants indicated the development which was possible under the local climatic conditions and the chief object of the present work was to attain or approach this ideal in the local forests.

- (b) An experiment carried out in the Dehra Dun garden, in 1913, showed that if rain-water was allowed to accumulate in non-porous pots, in which the basal drainage holes were tightly corked and which were filled with the local *sal*-forest soil, the latter was soon rendered entirely unsuitable for the growth of *sal* seedlings, although it was by no means saturated with water. It was found that, under these conditions, 100 per cent. of *sal* seedlings were either killed or had their roots extensively rotted when the water-free air-space in contact with their roots was maintained at 450 c. inches per c. ft. of soil, or less, for a period of six weeks, while seedlings in the same soil in similar pots but which were uncorked remained healthy. This experiment was repeated in 1915 with practically the same results. Fig. 3 (Plate 23) shows the appearance of the seedlings in these pots in September 1915. Note the healthy plants in the uncorked pots 7 and 9, as compared with those in the corked pots 6 and 8. This experiment, therefore, showed that the mere retention of rain-water for some weeks in contact with a *sal*-forest loam is sufficient to render the latter unsuitable for the growth of *sal* seedlings. In this experiment the soil was kept constantly moist by interrupting through drainage and creating a water-table near the surface of the soil, but the actual surface of the soil was freely exposed to evaporation through sun and

air currents during the experiment. This strongly injurious effect on *sal* seedlings of a constantly moist condition in loam, however, has also been obtained in another pot experiment in which good basal drainage was provided but in which the soil was kept constantly moist by merely diminishing the evaporation from the surface.

- (c) Sowings in 1912-13, in sample plots in the shade of the local *sal* forests and on similar soil in the open outside the forests, respectively, resulted at the end of the first rains in 7 per cent. and 37 per cent., respectively, of healthy plants, calculated on the number of seeds sown. Similar sowings in the following year resulted in 17 per cent. and 86 per cent., respectively, of healthy plants. In these experiments the death of the large number of seedlings in the shade was preceded by more or less extensive rotting of the root. In the shade plots the surface covering of humus and organic débris was first carefully swept off so as to expose the soil below and then a seed-bed was dug and prepared for sowing in the usual way. Notwithstanding this, however, in all the experiments, the surface soil in the shade plots during the rains was invariably found to contain a higher percentage of organic matter and water and a smaller volume of water-free air-space than did the surface soil in the open, this being due chiefly to the shade of the trees which materially reduced evaporation from the soil. During the rains of 1912, the surface soil of the shade plots did not contain more than 400 c. inches of water-free air-space per c. ft. of soil, whereas the soil of the open plots contained considerably less water and more water-free air-space. It will also be seen that, in the shade plots, the water-free air-space was actually less than has been proved to be highly injurious in precisely the same



Fig. 5.



Fig. 6.



Fig. 7.



Fig. 8.

- Fig. 5. Photograph of open plot III taken on July 20th, 1915, showing the appearance of the 2-years-old seedlings then surviving in the plot. The distance between this plot and plot XI. (see Fig. 4) is only 64 yards.
- Fig. 6. Photograph of shade plot VI taken on July 20th, 1915, showing the position of the beds and sand pots utilised in the experiment referred to in paragraph 3 (d). A number of plants had been removed from the sand pots and bed VI. (3) for examination before this photograph was taken.
- Fig. 7. Photograph of shade plot V taken on July 20th, 1915, showing the 2-years-old seedlings then surviving in the plot.
- Fig. 8. Photograph of open plot IV taken on July 20th, 1915, showing the 2-years-old seedlings then surviving in the plot.

soil in the pot experiments, see (b) above. In the dry season following the rains of 1912, also, more seedlings died of drought during the months of least rainfall in the shade than in the open plots. This was explained by the fact that although there was practically no difference in the soil water-content of the open and shade plots, respectively, at a depth of 3—9 inches during this period, the roots in the shade had attained, by May 1913, an average length of 6 inches only as against an average length of 18 inches in the open. The plants in the open, therefore, having their roots in the deeper moister soil layers were comparatively safe from damage by drought. Fig. 4 (Plate 23) shows a typical shade plot at the close of this experiment in July 1915, two years after sowing. Notice the absence of vigorous seedlings in the seed-bed. Fig. 5 (Plate 24), on the other hand, shows one of the open plots in the same month. Note the numerous healthy plants now two years old. The distance between these two plots is only 64 yards.

- (d) Sowings, in 1913, in large pots, filled some with clean sand alone and others with a mixture of clean sand and dead *sal* leaves which were sunk in one of the shade plots of the previous experiment resulted in a percentage of 82 healthy plants at the close of the first rains, as compared with 62 per cent. obtained in the adjacent soil from which the dead leaves and humus had been cleared for two years and 16 per cent. obtained in the same soil with which dead *sal* leaves had been mixed. The root-development in the sand was also materially better than that in the adjacent soil. Other experiments have indicated that the effect of this soil factor is progressively diminished by repeated removal of the humus, and also that removal of the humus by burning is practically as beneficial as removal by

brushing. Fig. 6 (Plate 24) shows the position of the pots and beds utilised in this experiment. 1—4 are the sand pots sunk in the soil, in bed VI (1) dead *sal* leaves were added to the surface soil, in bed VI (3) the dead *sal* leaves were removed by brushing and in bed VI (2) the leaves were removed by burning. As all the plants, in these experiments, were exposed to practically identical conditions of rainfall, light and temperature, the results show that the unsatisfactory development of seedlings in the shady forest is primarily due to a soil factor and not to deficient light, unsuitable air-temperature or air-humidity, and also that the injurious effect is increased by an admixture of dead *sal* leaves with the forest soil but is innocuous in a well-drained sand even when dead *sal* leaves are mixed with it.

4. With reference to the chief object of the present work, *viz.*, the establishment of vigorous seedlings in the local forests, the experiments detailed above indicated—

(1) that an injurious soil factor was chiefly responsible for the unsatisfactory seedling development, in the loam of the local *sal* forests, by causing high mortality during the rains and subsequently a high percentage of deaths from drought owing to poor root-development ;

(2) that this soil factor could be put out of action by sufficiently good soil-aeration.

It appeared probable, therefore, that clearing the forest growth, removing the humus and exposing the soil freely to sun and air would produce the soil conditions necessary for successful growth, provided that the area cleared was sufficiently small to ensure the light side-shade necessary in N. India for protection from frost.

In 1913, therefore, two adjacent sample plots were selected in a portion of the Dehra forests where sowings in the previous year had given unsatisfactory results.



Fig. 9.



Fig. 10.



Fig. 11.

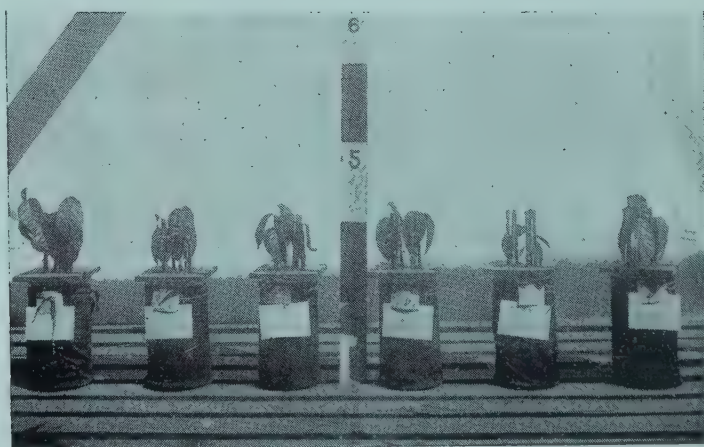


Fig. 12.

- Fig. 9. Photograph of open plot IV taken on July 20th, 1915. An area 60 feet in diameter was here clear-felled in May, 1913. The figure on the right shows the edge of the clearing. The experimental plot is shown inside the fence on the left and is seen more clearly in Fig. 8. In the centre is some coppice growth from the felled trees.
- Fig. 10. Photograph of open plot VIII taken on July 20th, 1915, showing the 2-years-old seedlings then surviving in the plot.
- Fig. 11. The 100 feet Thano-Joli line which was cleared in 1905. The figure on the left marks the position of open plot VIII, on the western side of the line.
- Fig. 12. Photograph of 12 *sal* seedlings which have been grown continuously in a water-culture solution for a period of 75 (in case of 4 plants on right) to 78 days (in case of 8 plants on left).

Above one plot, the overhead cover was entirely removed, in May 1913, before sowing, by felling all trees above and in the immediate neighbourhood of the plot, the total cleared space having a diameter of 60 ft., or a little less than the height of the surrounding trees. In the adjacent shade plot the cover was kept intact. At the close of two years, the percentage of healthy plants in the shaded and cleared plot, respectively, was 34 and 59, the percentage of the surviving plants which had not died back was 10 and 25, while the average height of the plants was 5 inches and 12.4 inches, respectively. The fact that the ground was worked and dead leaves removed for two years in succession was responsible for the results in the shade being considerably better than usual, but there can be no question as to the marked superiority of the open plot. In the cleared plot, also, taking only the four best plants (which would be sufficient to stock the area of the plot, *viz.*, 18' \times 3'), their average height was 21 inches, which fairly closely approaches the ideal seedling development for the locality, as obtained in the Dehra Dun garden and which was noted in para. 3 (a) above, *viz.*, 26 inches. Fig. 7 (Plate 24) shows the shade plot at the close of this experiment in July 1915. Note the development of the seedlings now two years old. Figs. 8 (Plate 24) and 9 (Plate 25), on the other hand, show the cleared plot at the close of this experiment in July 1915. Results almost as good as these have also been obtained on a continuous line, $2\frac{1}{4}$ miles long and 100 ft. wide, running E. N. E. to W. S. W. which was cleared through the local Thano forest in 1905. Fig. 11 (Plate 25) shows the line and Fig. 10 (Plate 25) the experimental plot on the western side of the line. The photograph was taken in July 1915 when the seedlings were two years old. The four best plants then showed an average height of 18 inches.

5. The conditions necessary for the successful growth of *sal* seedlings, therefore, may be said to have been determined as follows :—

- (1) a well aerated seed-bed free of raw humus ;
- (2) full overhead-light ;

- (3) light side-shade necessary to prevent damage from frost and which is also beneficial in keeping the soil moist in the dry season.

So far as can be seen at present, these conditions are best provided by the system of clear-felling in narrow strips and small patches, with artificial sowing and weeding during the first rains. At the same time, the method which produces the best growth is not always the best silviculturally. Thus, it is possible that the results obtained, excellent though they may be, do not yield a sufficient return to justify the high expenditure required, or the method may require more labour at a particular season than is locally available. Such considerations may render clear-felling impossible except locally in limited areas. The experiments carried out, however, indicate an alternative method of aiding the establishment of reproduction, *viz.*, by the continued removal of humus and dead leaves by light leaf-fires. In this way the number of *sal* seedlings on the ground can be materially and quickly increased. Their growth is decidedly inferior to that of seedlings established in the open, but it is probable that early removal of the overhead cover may soon remedy this defect.

6. As regards the identity of the injurious soil factor alluded to, all the facts hitherto ascertained indicate that it can be rendered innocuous by sufficiently good soil-aeration and, for the present, it may be conveniently indicated by the general term bad soil-aeration. It is not at present possible to define it more exactly or to indicate the precise way in which good aeration renders it innocuous. One thing, however, is clear, *viz.*, that the injurious action is not due merely to an excess of water in the neighbourhood of the roots. This has been proved by a water-culture experiment carried out at Dehra Dun during last rains, in which the injurious factor was found to be practically inoperative. In this case, after 75—78 days in the water-culture, only 8 per cent. of the *sal* seedlings died and the average length of healthy root in the surviving plants was 5.9 inches. A simultaneous culture in badly aerated soil for a period of only 67 days resulted in 93 per cent. of deaths and an average length of healthy root



Fig. 13.



Fig. 14.

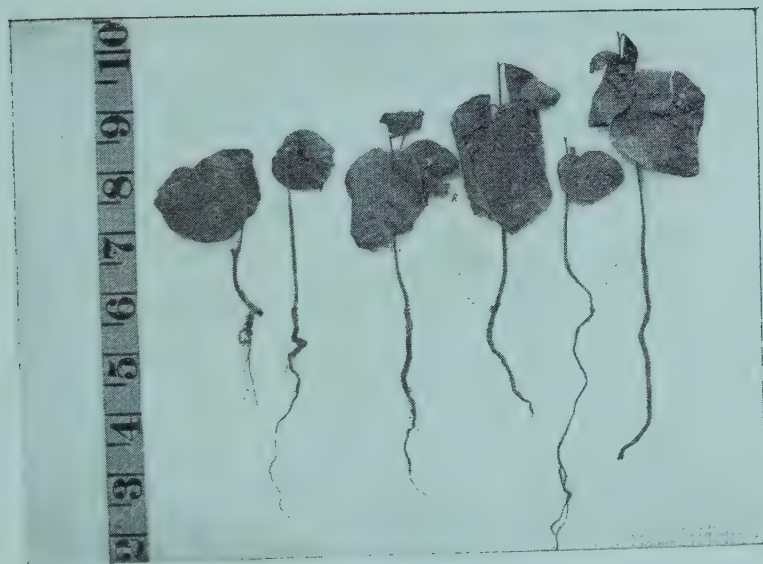


Fig. 15.

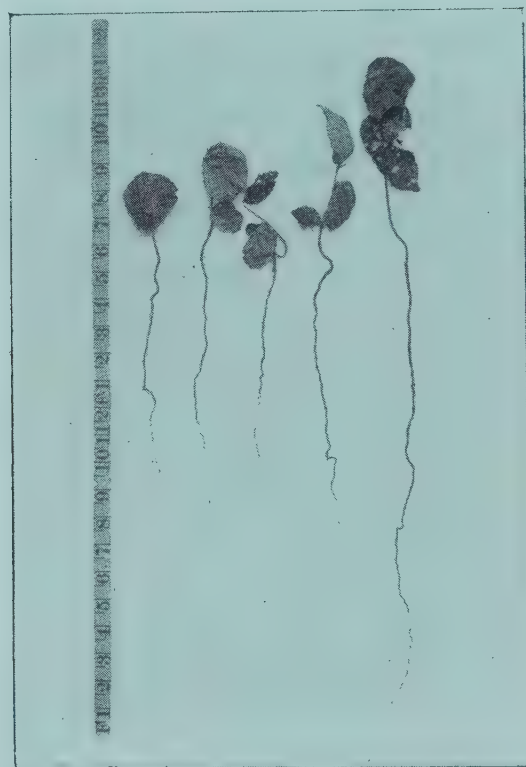


Fig. 16.

- Fig. 13. Photograph showing the root-development of 6 *sal* seedlings which have been grown continuously in a water-culture solution for 78 days, (in the case of the 4 plants on the left), and for 75 days, (in the case of the 2 smaller plants on the right).
- Fig. 14. *Sal* seedlings growing in heavy badly aerated loam. Note the position of the surviving plants, chiefly near the porous sides of the pot where the soil is kept well aerated by evaporation from the sides.
- Fig. 15. Showing the root-development of *sal* seedlings at the end of the first rains which have been grown in badly aerated loam.
- Fig. 16. Showing the root-development of *sal* seedlings, the same age as those shown in Fig. 15, which have been grown in well-aerated loam.

of 1 inch only. Fig. 12 (Plate 25) shows the appearance of the seedlings after 75—78 days in the water-culture. Fig. 13 (Plate 26) shows the root-development of six typical specimens. The infinitely superior results in the water-culture clearly show that the injurious effect of bad aeration is not due to water alone. Other factors possibly concerned are the lack of sufficient oxygen for root respiration and the accumulation in injurious quantities in the soil of one or more substances which are directly poisonous to the roots and which are probably chiefly produced as a result of the decomposition of the organic matter in the soil. Further work is required to determine the relative importance of these factors.

7. The details given above indicate that the two primary factors influencing the development of *sal* seedlings are :—

- (1) Bad soil-aeration which comes into operation especially in the rainy season.
- (2) Drought which causes widespread damage during the season of short rainfall from September to June.

The relative importance of these factors necessarily depends to some extent on the character of the soil. Broadly speaking, three principal soil types can be distinguished in the local *sal* tracts as follows :—

- (A) Containing a large percentage of sand and a relatively small percentage of finer particles of silt. The soil is also frequently shallow with gravel and boulders below and is, therefore, essentially dry.
- (B) Well-aerated deep loam.
- (C) Badly aerated deep loam. This differs from (B) chiefly in being denser with less pore-space per c. ft. and with a slower rate of surface percolation. Experimental cultures in these soils both in pots at Dehra Dun and *in situ* in the local forests and grasslands have shown that (A) is usually unsuitable for the best growth of *sal*, inasmuch as the water-content of the soil falls rapidly to the death-limit after the close of the rainy season, while (C) is unsuitable on account of bad soil-aeration which leads to a low percentage of

germination, a high percentage of deaths during the rains and a high percentage of deaths during the dry season on account of the superficial poorly developed root system.

On the other hand, *sal* attains its best development on soil (B). Fig. 14 (Plate 26) shows *sal* seedlings growing in soil (C) in a pot. Note the position of the surviving plants near the porous sides of the pots where the soil is kept well-aerated by evaporation from the sides thus indicating the necessity for good aeration in this soil. Fig. 15 (Plate 26) shows the root-development of seedlings grown on this soil at the end of the first rains, whereas Fig. 16 (Plate 26) shows the comparative root-development of seedlings of the same age grown on soil (B).

8. Observations have also shown that the above types of soils are locally characterised by distinct types of vegetation as follows:—

Soil (A)—Dry miscellaneous forests with such species as *Acacia Catechu*, *Dalbergia Sissoo* and *Bombax malabaricum* prominent, or grassland with *Saccharum Munja* dominant, see Figs. 17, 18 and 19 (Plate 27).

Soil (B)—*Sal* forest or grassland with *Saccharum Narenga* dominant, see Figs. 20 (Plate 27) and 21 (Plate 28).

Soil (C)—Moist miscellaneous forests with *Butea*, *Stereospermum*, *Terminalia*, *Cedrela* and others, or grassland with *Erianthus Ravennæ* dominant, see Figs. 22 and 23 (Plate 28).

In this locality, therefore, soil-aeration and the soil moisture-content appear to be the chief factors influencing the natural distribution of *sal* and the type of forest. It will also be noticed that the dominant grasses on an area may be excellent indicators of the soil conditions and therefore help us in selecting those grasslands and forest areas in which afforestation with *sal* offers the greatest chance of success. Their presence in a *sal* forest, also, indicates the treatment likely to favour reproduction. Thus, in this locality, where *Saccharum Narenga* is dominant the soil moisture and aeration are, as a rule, suitable for the best development of *sal* but in shady forests in such areas the seedlings are apt



Fig. 17.



Fig. 18.



Fig. 19.



Fig. 20.

- Fig. 17. A savannah of *Saccharum Munja* occupying the sandy soil on the banks of the Tons and Asan rivers, Dehra Dun.
- Fig. 18. *Acacia Catechu* forest established on an island of boulders and sand in the Song river, Dehra Dun. On the edges of the forest *Saccharum Munja* and *Saccharum spontaneum* can be seen.
- Fig. 19. Dry miscellaneous forest occupying deposits of boulders and sand on the banks of the Song river, Dehra Dun. The forest consists of *Bombax malabaricum*, *Odina Wodier*, *Acacia Catechu*, *Dalbergia Sissoo*, *Moringa pterygosperma* and others. On the edge of the forest are *Saccharum Munja* and *Saccharum spontaneum*.
- Fig. 20. *Saccharum Narenga* the dominant grass in *sal* forest near Jhajra, Dehra Dun.

to suffer severely from bad soil-aeration. The most efficient remedy here consists in decreasing the humus supply, coupled with partial removal of the overhead cover and exposing the soil.

On the other hand, where *Saccharum Munja* is dominant, this usually indicates a soil too dry for the best *sal* development and improvement should aim chiefly at increasing the soil-content of humus and water by continued protection and shade. On loam, where *Erianthus Ravennæ* is dominant, the main object should be to improve the texture of the soil. This will both improve the aeration and the water-supply. There appear to be two chief methods of effecting this : (1) by the introduction of an underwood as a soil-protection and thus increasing the humus supply, and (2) by cultivation of the soil. This will improve the soil-aeration by increasing the pore-space and will also increase the water-supply by facilitating the percolation of rain-water into the soil and by diminishing water-loss through evaporation. It is believed that these principles will be found to be of wide application in the *sal* forests of India generally and that practically all these forests can be placed in two main classes which may be termed Moist Sal and Dry Sal, respectively. In the former, the dominant grass is usually *Saccharum Narenga*, whereas the latter which occur both on sand and loam are characterised chiefly by such grasses as *Saccharum Munja*, *Saccharum spontaneum*, *Eragrostis cynosuroides*, *Imperata arundinacea*, *Vetiveria zizanioides*, *Andropogon contortus* and *Ischæmum angustifolium*.

9. From the above remarks it will be seen that the important characteristics of soils are, to a considerable extent, of a temporary character only, and that one of the most potent factors affecting the quality of the soil is the admixture of organic matter. This factor, also, is to a great extent within our own control. A second important factor also within our control is that of mechanical compression which affects soil-aeration adversely by reducing the pore-space. Fig. 24 (Plate 28) shows four *sal* seedlings all grown on the same soil taken from a local *sal* forest. The two central plants are one-year-old and were grown in the soil when well loosened, the others are 2-year-old plants grown in the same soil after it had been

moderately consolidated by pressure. Note the remarkable difference in root-development. This result of consolidation clearly indicates the harm that may be done by permitting grazing in *sal* forests on loam, especially during the rains.

10. It is not generally realised how greatly the characteristics of a soil may vary from place to place in a very limited area. Thus, in one of our forest experimental plots, the time in seconds required for $\frac{1}{2}$ inch of water to percolate below the surface in two spots, only 9 ft. apart, was 3,000 and 423, respectively. It is believed that local variations of this kind frequently account for the fact that groups of *sal* of good growth are often seen on a soil which, as a general rule, is not suitable for the best development. On a first class soil, on the other hand, *sal* would occur practically pure, throughout, instead of as isolated trees or groups.

11. With reference to the question of plant diseases, it may be noted that modern pathologists are now being forced to the conclusion that many of these diseases which were previously ascribed to fungi as the primary cause are really due to an unsuitable water-supply. Thus suitable conditions for the attack of the fungus *Valsa oxystoma* which kills out alder trees in Germany are said to be brought about by a deficient water-supply.

Again Dr. Appel, in a paper read at the 25th Anniversary of the Missouri Botanical Garden in America, in October 1914, stated that "The fungus diseases of our trees belong, in general, to the most important diseases, and we yearly lose millions on their account * * * Münch has proved through numerous experiments that the content of air in the tissues is the determining factor * * * the content of air is dependent on the quantity of water and the occurrence of this large class of plant diseases depends upon the water-supply."

From this point of view, therefore, it appears that the majority of the fungus diseases of our trees can be prevented, provided we can keep our plants in healthy vegetative activity with their tissues fully supplied with water, and that any factor interfering with the normal intake of water, such as drought or bad aeration, will therefore render our trees more liable to fungal diseases. In this



Fig. 21.



Fig. 22.



Fig. 23.

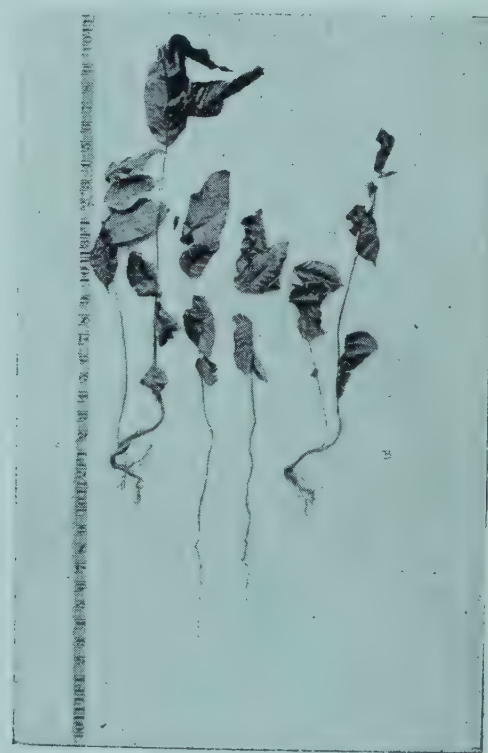


Fig. 24.

- Fig 21. *Saccharum Narenga* the dominant grass in *Sal* forest near Jhajra, Dehra Dun.
- Fig 22. *Erianthus Ravennae* in moist miscellaneous forest near Kansrau, Dehra Dun. The trees are *Odina Wodier*, *Butea frondosa*, *Gmelina arborea*, *Terminalia tomentosa*, *Mallotus philippinensis* and others.
- Fig. 23. *Erianthus Ravennae* in moist miscellaneous forest near Kansrau, Dehra Dun. The trees are *Mallotus philippinensis* and *Cordia Myxa*.
- Fig 24. *Sal* seedlings grown in loam from a *sal* forest. The 2 central plants are 1-year-old and were grown in the soil when well loosened. The others are 2-years-old plants grown in the same soil after it had been moderately consolidated by pressure. Note the difference in root-development.

connection it is significant that the *sal* root fungus recently discovered appears to be most injurious in the wet *sal* forests of Assam and the Bengal Duars where the absence of reproduction is known to be due chiefly to bad soil-aeration. The *sisoo* root fungus, also, is most injurious in *irrigated* plantations. Again the symptoms of Spike Disease of *sandal* strongly resemble those of a plant suffering from an excess of CO_2 . The latter gas is known to accumulate in soils under conditions of poor aeration, and it is possible that deficient soil-aeration is the factor which, in some cases at least, is responsible for the disease. In other cases it seems probable that a deficient water-supply, due to the absence of suitable hosts or drought, is the primary factor and this has already been suggested by local officers who have had an opportunity of studying the disease in the field. There is thus reason to believe that the continued study of the requirements of our important species in respect of soil-aeration and water-supply will give us valuable results in connection with the prevention of diseases.

That the view here taken regarding plant diseases has now been adopted to a considerable extent in India will be seen from the following extracts from the latest Annual Report of the Board of Scientific Advice for India.

The officiating Imperial Mycologist at Pusa, discussing the *sal* root-fungus from the point of view of the expert Mycologist, says: "The fungus has been obtained in pure culture and will be tested by inoculations. While it is not unlikely that the fungus is the direct source of damage, it will probably be found that the conditions under which the *sal* trees are living are such as favour the presence of a fungus parasite and decrease the vitality of the *sal* tree. When the factors which are necessary for the fungus to gain an entrance into a healthy *sal* tree are known it may be possible to control the disease by altering the hygienic conditions under which the trees live and thus lessening the chances of a successful infection."

Again Mr. Howard, the Imperial Economic Botanist of Pusa, referring, in the same report, to the Dehra Dun work on *sal*

seedlings, says : " In the development of *sal* seedlings in the forest and also in the case of many agricultural crops in India, want of sufficient air for the soil organisms and roots has been found to be a limiting factor in growth. The proper aeration of the soil is chiefly interfered with by excess of moisture either in the form of rain or as irrigation water. Unless the proper relations between air and water are maintained, it is found that growth slows down and finally a diseased condition results. Water, when it excludes air from the roots, soon acts as if it were a poison to plants. As soon as gaseous interchange between the soil and the air is interfered with, there is considerable evidence that the proportion of oxygen in the soil atmosphere falls while, at the same time, the carbon dioxide rapidly rises. If this condition continues, a slow poisoning of the plant begins and, after the cessation of growth takes place, the foliage becomes yellow and unhealthy. The next stage is that of well-marked disease, often accompanied by invasion of the tissues by insects and fungi which are not unnaturally regarded as the causes of the trouble. * * * * There seems no doubt that the rôle of insects and fungi in the diseases of crops has been somewhat exaggerated and that a truer point of view is to regard these so-called pests as indications that the well-being of the crop is being interfered with by causes such as unfavourable conditions of growth, due to the soil or to the climate."

In conclusion, it must be noted that the results which have been mentioned in this paper are very largely due to the hearty co-operation of Mr. Puran Singh, our Chemical Adviser, who has carried out all the analyses of soils and water determinations.

SOME PHASES OF FOREST ADMINISTRATION IN CALIFORNIA.

BY THEODORE S. WOOLSEY, JR.

In a former article on "The American Forest Service," published in the *Indian Forester* (June and July 1909), the writer gave a brief account of the organization of the Forest Service, of the amount of business it was transacting, and some of the technical phases of the work, such as timber sales, marking and silviculture. Since that article was published, the organization has not been materially altered. There have been some changes, however: the district organization has been simplified. A new district, District 7, has been founded, which manages the lands purchased under the Weeks Law; new forests are being organized in Tennessee, Georgia, Virginia, North Carolina, West Virginia, and New Hampshire. This new district, which has its headquarters in Washington, also includes the Arkansas, Florida, and Porto Rico (not organized) forests, formerly administered by District 3 at Albuquerque, New Mexico.

In the Central Bureau in Washington, there have also been some changes. A new branch, entitled "Research," has been established. The Forest Service is now directed, as in 1909, from Washington. It is headed by a "Forester." There are seven districts each in charge of a district forester, and 153 forest administrative units each under a forest supervisor. The Central Bureau is divided into accounts, operation, silviculture, grazing, lands and research. The editorial and special hydro-electric engineering work and dendrological studies are directly under the forester and not in any particular branch. The district forester is advised by a solicitor working under the solicitor of the Department of Agriculture, and the various district offices are: Accounts, Operation, Silviculture, Grazing, and Lands. The forests are divided into ranger districts, but often important projects such as large timber sales are under the charge of specialists without relation to the ranger in charge of the district, but instead directly under the forest supervisor. Since 1909, eight experiment stations have been established, and the importance of research work has

increased tremendously since the early organization. Most of the stations undertake experiments of general value, the results of which will apply directly to future administration. There are some exceptions: the Converse Experiment Station on the Angeles National Forest in Southern California specialises in planting. The Wagon Wheel Gap Experiment Station on the Rio Grande National Forest in Colorado is run in co-operation with the Weather Bureau in order to determine scientifically the effect of forest cover on run-off and the related problems. The final results will be authoritative and of world interest.

According to the October 14th report of the Forester for the fiscal year ending June 30th, 1915, a net area of over a million acres of land was eliminated from national forests during the last fiscal year by acts of Congress. The net area as of June 30th, 1915, excluding private interior holdings, was 162,773,280 acres. During the same period, the cash* receipts were \$2,481,469.35, of which 1.17 million was derived from timber, 1.14 million from grazing fees, and .17 million from special uses and rentals. While this was an increase of less than \$50,000 over the year before, the small increase is clearly accounted for by the depressed lumber market due in part to the European War. These returns do not include almost a quarter of a million of free use material which was donated to settlers. The receipts were less than half the appropriation required for carrying on the Forest Service. In other words, no revenue is derived, but, instead, the Service nets the Government a loss of over three million dollars. The main reason for this large deficit is because the forests were organized not alone to take care of the revenue-producing business, but also to protect vast bodies of valuable timber which cannot as yet be placed on the market.

Reforestation by direct sowing was continued and a total of 5,876 acres were sown; the area planted was 9,731 acres, and, according to the Forester's report, "The area planted annually will be kept normally at 14 or 15 thousand acres." The average cost was ten dollars per acre for plantations and \$4.39 per acre for direct sowing.

* One dollar = about Rs. 3.

It is undoubtedly of interest to Indian foresters to learn that 25,641 permits were issued for stock grazing and that 1,627,321 cattle, 96,933 horses, 2,792 hogs, 7,232,276 sheep, and only 51,409 goats were grazed. Only \$400,000 was available for the "construction and maintenance of improvements." Consequently, the maintenance of 108 miles of road, 1,719 miles of trails, 2,287 miles of telephone lines, 166 miles of fire-lines, 102 look-out structures, 35 bridges, 267 miles of fence, and 696 dwellings, etc., 23 corrals and 202 water improvements is an excellent record. Naturally part of this work was accomplished by employees on the statutory roll. According to Act of Congress, ten per cent. of the gross receipts is available for local road-building under the direction of the Forest Service. This supplements the twenty-five per cent. of the gross receipts which "is paid over to the States by the federal government for the benefit of county schools and roads." Since the forests cannot be taxed locally, this payment is really in lieu of taxation, and when the forest revenue is largely increased, as it will be, it will mean a handsome sum for the civil governments. The road and trail money expended under the direction of the Forest Service was nearly a quarter of a million, and the school and road money spent by the counties more than half a million. Besides the Forest Service in Washington, there are, in addition, 34 State "Forest services" and these are aided by federal appropriation for fire-protection as soon as the State qualifies by passing a suitable forest fire law.

Notwithstanding the fact that each district works under practically uniform laws and instructions, there is some variation in the methods of work due in part to different local conditions and in part to the variation of ideas between the district foresters. I will allude, however, to but one of these variations. This variation is one in organization and is illustrated by the following table:—

District.	Number of administrative units.	Gross area of district (million acres).	Average area of administrative unit (thousand acres).
1	26	27	1,036
2	32	23	716
3	16	21.5	1,345
4	34	30	875
5	19	26	1,376
6	26	27	1,951
7	(Not considered)		.
Total	... 153	Average area per district. 25.75	

A check of this table shows that the average number of units per district is 25 ; the minimum of 16 for District 3 and the maximum of 34 for District 4. The average unit is slightly over one million acres, but varies from 715,740 acres per administrative unit in District 2 to a maximum of 1,376,208 acres in District 6, with District 3 a close third to the maximum with 1,345,978. Surely such a tremendous difference in the average acreage between administrative units in Districts 3 and 2 must signify a fundamental difference in organization followed by the two district foresters. This is all the more significant when it is realised that District 3 is planning a further increase in the size of its administrative units by reducing the number of supervisors from 16 to 8. This, however, has not as yet received the sanction of the Central Bureau although recommended by the district forester. The reason for this difference is an interesting one. In District 2 the district office evidently believes in a personal administration by each supervisor. In District 3, the district forester feels that a supervisor on a first class unit should be assisted by a staff of grazing, timber sale, lands, and engineering specialists. In other words, he argues that, notwithstanding the duplication of travel, that it is better to have the supervisor and his alternate (the deputy forest supervisor) leave to specialists the work of specialists. This is a question which has

not, as yet, been decided, but the problem is of keen interest to every professional forester. My own idea is (at least in theory) that with a local staff organization, which must naturally follow if the supervisor has 3 or 4 million acres to administer, there is no need for the present district organization; that it would be better to have the administration wholly centralized in Washington with one or more general inspectors for each district to supplement specialist's inspection from the Central Bureau. This is a problem which merits close scrutiny on account of the enormous expense of the present districts.

From this brief allusion to the organization and business of the present Forest Service, it will be seen that the business does not really justify the present organization unless the deficit is charged to the protection and recreation value of the forests. I feel that the money is well spent, but that it would probably advance the business efficiency of the organization if all research and co-operation were placed in a separate bureau, and the business of organizing and administering the national forests separated and financed as a distinct project.

It has been seen that California in its entirety comprises one of the six districts locally known as District 5. California has commercial forests and non-commercial forests, those in Southern California comprising the Santa Barbara, Angeles and Cleveland are non-commercial forests. According to Smock*—

"Southern California may be divided into three fairly well-defined topographical divisions: The intra-mountain or Mojave Desert region in large part; the mountain consisting of the Sierra-Madre and San Bernadino and San Jacinto ranges, and the coastal plain, that part of the State lying south and south-west of these ranges and stretching westward to the ocean."

The national forests occupy the second or mountain division and, unfortunately, contain but little merchantable timber. A large part of these forests is brush land, so-called "Chaparall." The more important species in the timber types are western yellow

* "An afforestation scheme for Southern California," John C. Smock, No. 4, Vol. 9, Proceedings of Society of American Foresters.

pine, white fir, and Douglas fir. The brush is chiefly manzanita (of the *arctostaphylos* genus), snow bush and white thorn. This Chaparral cover is of value in preventing erosion and in retaining soil moisture, but has no commercial value worth mentioning. Smock in his article calls attention, however, to the large areas of land outside national forests in Southern California which should be afforested to ameliorate the climate by reducing somewhat the wide daily range of temperature and by increasing air-moisture and to prevent frosts. The tremendous value of the coastal plain region*—the agricultural area—comprising, in Southern California, about 3,000 square miles, is well known. It is probably the most valuable agricultural land in the United States and, consequently, the 3,500 square miles not suited to agriculture, practically unproductive of any revenue to the State, leads the forester to consider forestation notwithstanding the difficulty and expense. In concluding his article Smock says:—

“This afforestation on the large scale, as suggested in this paper, as a means of making the streamflow of these wild lands of value, of increasing the rainfall to a slight extent, and of reducing the losses of heat and moisture through evaporation, and thereby producing a slight amelioration of the climate, would in time yield a return in forest products which might in time be of sufficient value to pay in part the invested capital. Timber values can be computed with reasonably accurate estimates, even on so large a scale. If the investment were lacking in commensurate profit, the additional water-supply for local use in the surrounding valleys would be a perennial source of wealth to the country. The enrichment in natural beauty and the attractiveness would constitute elements of public wealth in justification of so large a scheme of afforestation.”

The only objection to foresting these low-lying hills is the large increase in real estate values and the extension of suburban residences 20 to 30 miles from the municipal centre of Los Angeles. Enthusiasts predict that some day even the low-lying hills around

* It is similar to some of the best coast land in Australia as contrasted with the interior “bush.”

the coastal plain will be required for residences, but the forester will argue that this is all the more reason for afforestation to increase and preserve an already scanty water-supply and to enhance the local beauty.

The importance of the Angeles Forest (formerly known as the San Gabriel and San Bernadino Forests) comprising 1,159,663 acres gross area, of which 271,629 acres is alienated, is two-fold: first, as a watershed and drainage area, second as a camping and recreation ground for a local population of over a million people. With the present wide ownership of motor cars, the Angeles Forest is even more accessible to the public than even such play-grounds as the Wienerwald near Vienna or Fontainbleau near Paris. I am reliably informed by the supervisor of this forest (R. H. Charlton) that, on July 3rd, 4th and 5th, 1915, no less than 1,800 people picnicked in the Arroyo Seco above the town of Pasadena to the north-east of the City of Los Angeles. Charlton estimates that "350,000 people so use the forest annually."

The flood of 1914 aroused the supervisors of Los Angeles County to the necessity of immediately taking steps to prevent the recurrence of damage conservatively estimated at a direct physical loss of \$7,600,000 by the Provisional Report of the Board of Engineers, June 3rd, 1915. It is significant that* "All the waters that bring about the destructive floods rise in National Forest Reserves which occupy 1,520 square miles of the total 4,967 square miles of Los Angeles County." According to the preliminary report:—

"The methods available for flood control are broadly separable into two general classes opposite in their action. First, those which accelerate the discharge of the main streams, such as improvements and straightening of channels. Second, those which retard and regulate the flow of feeders into the main streams, such as dams, the spreading of waters, the planting and preservation of trees and especially of low growing bush and willows."

* Page 3 of Provisional Report of Board of Engineers, June 3rd, 1914, p. 22.

It was estimated that disastrous floods occur at least once in eight years and that there were "Heavy floods in the Los Angeles River in 1825, 1833, 1862, 1867, 1886, 1889 * * * and serious floods in 1892, 1906, 1911 and * * * 1914." * The rapidly increasing value of the land to be protected is a factor to be considered.

The improvements on the Angeles Forest for the year ending June 30th, 1915, were: Trails, 53.4 miles; telephone lines, 17 miles; fire-breaks, 6.1 miles; 1 look-out tower; 1 house; 1 barn; 1 small building; 1.05 miles of fence. Since the forest was organized it is interesting to note that \$146,265 has been spent on improvements, the most important items being: Trails, \$94,036, fire-breaks, \$22,669, dwellings, \$11,462. The most remarkable spirit of co-operation exists. In 1914, 44 private owners, corporations, municipalities contributed \$20,078 towards patrolling, trails, fire-breaks, telephone lines and look-out houses. On no other forest in the country is there the same co-operation; *this in itself is a formal public recognition of the indirect value of forest protection.* For example, the San Antonio Fruit Exchange contributed \$1,499 to protect the San Antonio Canyon; this money is raised by taxing each box of citrous fruit at a quarter of a cent. No less than 333 special use permits were issued, making a total in force of 957; this is evidence of the wide use of the forest by the public. While such wide use is of revenue importance, it also means an added fire menace.† No less than 581 of the permits in force were for residences. Other permits issued were for agriculture, apiaries, camps, dance halls, fish hatcheries, parks, pastures, photo studios, resorts, road houses, schools, stores, garages, telephone lines, trollies and water development. Permits were also issued for the grazing of 3,054 horses and cattle; no sheep or goats were grazed. No timber sales were made for amounts over \$100 and but 581,000 ft. B. M. were cut during the fiscal year. The planting covered by 64

* Disastrous floods occurred again in January 1916, just as the article is being mailed.

† See next note by Charlton.

acres and the sowing 2.8 acres; infinitely poor results owing to drought and frost. The practical abandonment of planting or sowing other than on an experimental scale is an acknowledgment of the difficulties encountered.

In 1906, the expenses were \$30,910, the receipts \$1,819, giving a deficit of \$29,091. This was for the first fiscal year that the Forest Service took charge. In 1913, the expenses were \$57,458 and the receipts \$15,814, giving an increased deficit of \$41,643, notwithstanding the large increase in receipts because of the expensive organization which is maintained largely on account of fire-protection. In 1914, the expenses had increased to \$62,504 and the receipts to \$28,286; the deficit was \$34,318. This is a cost per acre of .05363 and the receipts .02427. During the past fiscal year (1915) the net receipts were but \$15,005. Of this \$1,276 came from the sale of timber, \$32 from timber trespass, \$1,502 from grazing, \$9,774 from special uses, and \$2,421 from water-power. These receipts, much lower than those of 1914, are less because of the small payments for use in hydro-electric power. Ordinarily the receipts from now on will be well over \$30,000 and probably soon will reach the \$40,000 mark. It is noteworthy that Mr. Charlton, the present supervisor, has increased the revenue from \$1,819 in 1906, when he took charge, to a maximum of over \$28,000 in 1914. Such an administration is unquestionably quite remarkable and he confidently predicts further increases in revenue. The deficit in receipts is emphasized because I want to show that the United States is progressive enough to spend a great deal of money on forests that are practically worthless commercially, in order to protect valuable water resources and in order to furnish a play-ground for the people.

The important work on this forest is, first, fire-protection, and second, construction work in connection with fire-protection, and in order to give access to the forest for campers, third, location and control of summer residents* and transient campers. These will be discussed in the order given.

* Charlton states that :

"The summer resident is not necessarily an added menace. For instance, we require him to clear his lot of all inflammable debris, and having a financial interest in the canyon, he really becomes a member of our protection force."

In the words of the district forester :—

“Fire-protection is not only a public service of vital importance, but it has become a game to us, a game which we play with increasing enjoyment. Evidently the district forester has in mind a game similar to that of the game of war ; a game to be sure, but withal an exceedingly serious one. The causes of fire within the Angeles Forest in the order of importance are : campers and hunters, railroads, brush burning, and of less importance, lumbering, lightning, incendiary, miscellaneous and unknown causes. Naturally, the first aim of the force is to prevent fires. With fire once started in the brush (which is very much like the ‘maquis’ of Corsica), it is very difficult to put it out, since these fires usually start in the bottoms of canyons or at the foot of slopes and can rarely, if ever, be controlled until they have reached the summit, notwithstanding the fire-lines which have been constructed. The preventive firework naturally aims at the most important causes. With the wide use of the forest, it has been found necessary to issue so-called ‘camp-fire cards,’ authorising the building of camp-fires on National Forest lands. While these permits could probably not be legally enforced without a secretary’s regulation or a local State law yet they have been accepted by the camping public without exception. The permit authorises the bearer to build camp-fires between certain dates, subject to the following requirements :—

- “(1) To build camp-fires only.
- (2) To build fires in the open and not against a tree or log nor within 20 ft. of standing brush.
- (3) To scrape away all leaves and brush from around fire.
- (4) To never leave a fire unattended even for a short time without first extinguishing it.
- (5) To extinguish fires first with water and then to cover with dirt. Bonfires are not allowed on the Angeles National Forest.”

On the reverse of the cards, campers are informed what to do in case they find a fire ; first, try to put it out, then get word to the nearest ranger. The supervisor’s telephone

number is given as an additional precaution. They are also cautioned to leave their camping grounds in a sanitary condition, not to pollute streams, not to throw away lighted matches, cigars or cigarettes, and finally—

“The Angeles National Forest is maintained by the Government for your benefit. Please co-operate and prevent fires.”

The rangers have even built rock fire-places for picnickers to lessen this particular danger; special camping grounds are also reserved. Of course, the usual fire-warning posters are along all roads and trails and, in addition, there are special notices to campers as for example, “Camp-fire cards must be obtained from the ranger before fires can be built on national forest land.” The regular fire warnings are printed both in English and Spanish and, in addition, there are frequent placards giving the addresses of the fire-prevention force, rules for the prevention of fire and warnings about prosecutions which will follow violations of the law. To prevent fire from railroads, fire-lines parallel with the track are constructed and kept clear; these commence at the right of way and extend a distance of 100 ft. from the track. To prevent fires from indiscriminate brush-burning notice must be first given by those wishing to dispose of *débris*, and inside and outside the forest fire officials either from the Federal or State service are usually present.

The situation of the Angeles Forest, bordering areas of agricultural land makes the prompt detection of fire fairly easy, since the whole country is connected with an efficient telephone service. On most national forests, the key to the fire-preventive scheme is a series of fire look-outs connected by telephone with the district fire chief, who, in turn, is connected with the supervisor's office. On the Angeles, thus far, but one fire look-out has been established. Charlton believes in prevention rather than in detection.

“We realise that a fire once started in the brush is very difficult to control, and for that reason do all in our power to educate the city people who frequent these hills on the danger of leaving fires.”

A good deal of difficulty has been experienced with look-out stations on account of the haze which obstructs the view. The chief preventive measure is, therefore, patrol, which of course is exceedingly expensive; probably more look-outs may be used in the future, but patrol will always be very necessary on account of campers. The preventive organization attends fires only on its own district. There are three division rangers at Pasadena, San Bernadino and Upland, where the supply depôts are located. Supply depôt chiefs, in case of fire, see to it that crews of men and "straw bosses" are sent out by motor truck and that the proper tools and food are despatched immediately. Of course, the location of each fire district is clearly established on the map and the fire-tools, supplies and fire-fighters are all arranged for in advance.

Even the field officers have very detailed directions, instructing them to "phone the division ranger how many men to be sent, how to be sent, what tools to send, rations, what work, outfits and bedding, and to make sure that there is no duplication of orders." The district forester is very keen for a large fire supervisory force and a detailed organization when once fire is discovered.

Suppose that a fire has started. According to the organization chart, the division ranger, or, if it is an important fire, the supervisor would be in direct charge. Under him, there would be a chief of fire-fighting with a division leader and crew leaders (straw bosses), in charge of from ten to twenty fire-fighters. There would be a quarter-master, with a commissary chief superintending the cooking, and a transportation chief to see to the motor transportation, team hire, pack outfits and saddle horses, an equipment chief to look after tools and special equipment, a powder man to supervise blasting, a communication chief to supervise telephone, heliograph messages, and messengers, a time-keeper with the necessary assistants, and a paymaster. At the fire which I attended on this forest, the organization was not quite so complicated, the following procedure being followed: The fire was in Lydle Creek, some 15 miles out of San Bernadino. The division ranger remained in San Bernadino and saw to the shipment of men and supplies, as well as proper publicity, while the fire was

raging. The supervisor had general charge at the base camp and directed the fire campaign after consulting with the various local rangers. Each crew of ten to twelve men was in charge of a boss, and messengers were employed to send water, food, and give directions to the crews. A commissary chief checked over the supplies and gave them to the cooks. The chief clerk of the supervisor's office acted as time-keeper, assisted by an office stenographer. The feature of the time-keeping was a serially numbered card with places for the date and the time for going on-shift and off-shift, with a summary of the number of hours worked during the day from midnight to midnight. At the bottom of the slip, the rate per hour for fire-fighting (in the United States,* the standard rate is twenty-five cents; Charlton pays "bosses" forty cents), with an additional space for recording the number of hours spent in coming to and from the place where the labourer was engaged. At the beginning of the fire, each labourer (whose name and address was inscribed at the head of the time slip) was given a numbered slip which identified him definitely by number. Time was kept by numbers only.

Most of the men seemed familiar with their duties on account of past experience in fire-fighting. The food-supply distribution was systematised. For example, when making up lunches for the men, bread was buttered by painting melted butter on the bread with a paint brush. The usual lunch was cheese, sardines, bread and butter, and jelly. In camp, the men received beef, potatoes and coffee. Special fire-irons had been brought from town for the cooks and board-tables were arranged in a semicircle, much as you find in railroad lunch counters. Quilts were provided for the men to sleep in when off duty. The lighting equipment was kerosene lanterns and acetylene pocket lights, which, by the way, failed to act properly, axes, shovels, and grub hooks. When a fire is once controlled, great care is taken to patrol the burned areas to prevent a re-kindling of the fire-lines; men even creep along these lines and feel the burned ground with their hands to make sure that nothing inflammable remains.

* One rupee = about 32 cents.

In some of the very large fires which have devastated California forests, the danger point in the organization has always been reached when one man tried to do it all himself. It is for this reason that the district forester is strongly in favour of spending a little more money on this apparently top-heavy fire-fighting organization. On March 20th, 1914, 1,600 acres were burned over in Evey Canyon. The fire was caused by the transmission wires of the Sierra Power Company blowing down in San Antonio Canyon. The wind was so strong at the time that houses were unroofed in Pasadina and ashes from the fire were carried to Glendora, twelve miles away. The fire started first at 9-30 A.M., and was controlled the first night. The S. P. L. A. and S. L. fire, November 19th, 1914, in Cajon Pass, was started by the railroad, 110 ft. from the outer rail. 1,203 acres were burned over, and the cost of putting it out was \$1,450. These two examples of recent large fires show what would happen to the forest without the expenditures on fire-protection.

To simplify the collection of fire-trespass money, the local officers have based the damages on the artificial cost of replacement when young growth is wiped out. For example, if the growth is ten years old and two feet high, its value is estimated at \$16.30 per acre. If sixty years old, and eight inches in diameter, the damages are assessed at \$73.14 per acre. In addition, they add the sale value of the wood destroyed. The figures just quoted are based on a replacement cost of \$12.00, a protection cost of .015 per acre every year, interest at three per cent. compounded annually, and 1,200 trees per acre.

On account of the vast amount of improvement work on the Angeles Forest, special cards are maintained to show the cost of construction (with additions) and the maintenance cost of each project. The cards show the name of the project, who supervised construction when it was constructed, whether it was built by the Government or by local subscription, location, name of terminals, length on specific dates, dimensions (if a house), losses, abandonment, or transfers, whether the project was administrative, protective or range. A detailed description of the project is given in a



Photo-Engraved & Printed at the Photo-Mech. & Litho. Bldg., The Mason & Co., Boston.

Damage from fire on the north-east slope of the San Francisco Peak, California.

summary. The road work is laid out by road engineers, and, thus far, the trails have usually been located by rangers or by the supervisor himself. The fire-lines are usually laid out under the personal direction of the district ranger or the supervisor, and the scheme thus far parallels the foot-hill areas below the forest, but not necessarily along the boundary. These lines are usually sixteen to sixty-six ft. wide, most of them being narrow rather than wide, since they are designed to give vantage points to fight fires from or to give access through the bush to fire-fighting points rather than to stop the fire of themselves. More fire-fighting lines have been built on the Angeles Forest than on any other forest in the United States (up to January 1st, 1916, 133 miles) and the supervisor has developed the theory and practice of fire-line construction to a suitable degree. Commenting on the width and method of construction and periodical clearing, Mr. Charlton says:—

“The first fire-breaks constructed averaged 50 ft. in width, were grubbed of all roots, and were constructed with the idea that under normal conditions they themselves would check a brush fire. This they did, provided the fire reached them when there was little wind, as at night but, unfortunately, the time element could not be controlled and the breaks could not always be depended upon. We are now building narrow lines, averaging 12 ft. in width and grubbing the roots, but making no effort to clear them of the weeds and grass that annually grow upon them. By making them the same width as the height of the contiguous brush we reduce like conditions to a minimum and thereby secure a minimum growth of vegetation upon them. These breaks are designed, first, to render the ridges accessible to fire-fighters (the Chaparall is almost impenetrable) and, secondly, to afford a place from which a back-fire can be set. The breaks invariably follow the main divide of each watershed, with laterals running to the bottom of the canyon. The Forest Service is now purchasing a flock of sheep to be grazed upon the fire-breaks throughout the year. Heretofore the cost of maintaining a fifty-foot break by hand (hoeing the weeds and grass) has been \$100 per mile. With

sheep it should not cost more than \$10, and if the profits of the business are considered, should be even less."

The third great industry on the Angeles Forest is the special use business; chiefly the rental of camp sites to local residents (who occupy them during the summer months) and a conservation charge for hydro-electric power. Practically every canyon on the forest, that is now accessible and where water can be found, is occupied by permanent campers. Little house lots are surveyed in advance by the Forest Service and the corners marked. Thus the renting is systematised and conducted in very much the same manner as a real estate company rents private property. But priority of application, rather than ability to pay a high monthly rental, is the governing criterion. The rental for a small camp site is usually about \$15 a year.

As time goes on, the revenue from the rental of sites will become increasingly large, especially when new automobile roads are developed. One of the scenic drives of the United States is from San Bernadino up to Skyline, to Big Bear Lake and back to San Bernadino, a distance of 101 miles. All along this road, where there is water, temporary and permanent camps are found between the hotels and lodges.

The forester is acquainted with the revenue-producing forest, the sale of timber and grazing, but it seems to me that the Southern California forests of which the Angeles is the best developed are noteworthy in illustrating the indirect value of forest protection. Here, we will have, in years to come, water protection and recreation developed to a maximum.

Professionally, some changes in the present order of administration are desirable. For example, the Cleveland Forest should be combined with the Angeles, with a central administration at Los Angeles. If this combination were made, it is quite likely that the supervisor would require a fire expert, who would also be an engineer to superintend improvement work, and, if the renting business increases, perhaps a lands expert to locate and designate even more permanently than is done at present,* the various rental

* On January 24th the supervisor reports that three field parties are staking, numbering, mapping, and surveying residence sites,

sites, and to assist the supervisor in formulating rules and policies governing this form of business. On account of the cement boulevards radiating from Los Angeles, even as far as San Diego (the southern limit of the present Cleveland Forest), it seems to me that it would be wise for the supervisor to maintain an automobile. Under the present arrangement, he could do so and receive an official mileage allowance which probably pays half the net cost per mile. Where the supervisor cannot afford this, as in the present case, it seems logical for the government to supply a motor car or cheap motor cycle for speedy transportation ; or better still pay a fair mileage. Personally, I see no reason why the government should expect its officials to bear part of the cost of field transportation as might be supposed judging from the present niggardly allowance. As far as fire-protection is concerned, a good sturdy motor truck (geared so that it could be run up to thirty miles on the boulevards and with a very low gear for hill-climbing), would be a wise business economy. As regards fire-lines, which are the all-important work, the main problem is keeping them clear of débris. Considering their purpose, I should like to see the experiment tried of having one-third the width cleared each year rather than the whole width cleared every three years. This is a scheme advocated in Algeria by one of the local officers in order to have part of the line absolutely clear of grass and débris every fire season.

The development of the Angeles Forest by Supervisor Charlton is a distinct contribution to American forestry and should be so recognised ; the progress of the next ten years should be phenomenal. Let us hope that the experimental afforestation will indicate that extensive planting is feasible in Southern California.

EFFECT OF DROUGHT ON THE SAL IN THE RAMNAGAR FOREST DIVISION.

BY E. R. STEVENS, I.F.S.

It is a curious fact that at the time of writing this note (the 29th May) the greater proportion of Sal saplings and poles up to about 3 feet in girth in the Ramnagar Division are still leafless or comparatively so.

The larger Sal trees, on the other hand, have had their full leaf-canopy since before the end of March, the leaves having in their case begun to arrive noticeably early as a result of warm weather setting in somewhat prematurely this year.

The foliage of the larger trees is, however, in many cases feeling the effect of the long drought and is becoming very yellow and in some cases the new leaves are withering and beginning to fall.

The larger the trees, the less have they been affected.

The obvious inference is that early in the season the water-level had been reduced to such an extent as to throttle the rise of sap and check the leaf production of the younger trees while the more developed and deeply reaching root-systems and tap-roots of the older trees rendered these latter at that time immune.

Continued drought and lowering of the water-level is now however telling on the larger trees. If the drought persists much longer or even if there is insufficiency of rain during the next month it is difficult to foretell whether the hastiness of the more mature trees to don their spring garments may not prove more prejudicial to them than the absence of raiment and check in growth to the younger trees during the last few months. There must be lowered vitality in both cases and I think a bigger death-rate than usual may be expected among the Sal of all age-classes in this Division.

It would be interesting to know if similar conditions prevail in other divisions in the provinces.



Photo.-engraved & printed at the Photo-Mechl. & Litho. Dept., Thomason College, Roorkee.

MAIN BUILDINGS, FOREST COLLEGE, MADRAS.

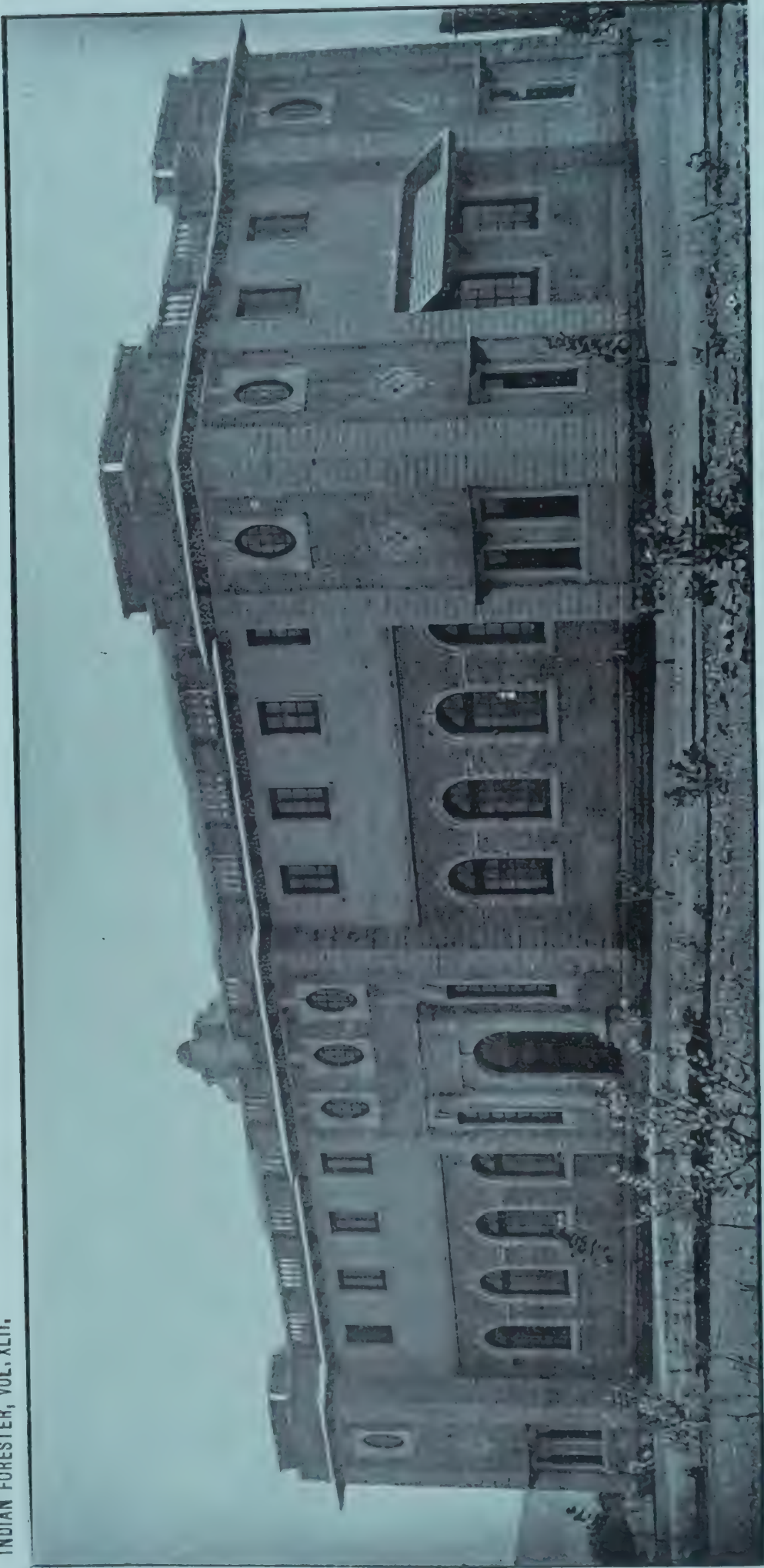


Photo engraved & printed at the Photo-Mechl. & Litho. Dept., Thomason College, Roorkee.

GASS FOREST MUSEUM.



Photo-engraved & printed at the Photo-Mechl. & Litho. Dept., Thomason College, Roorkee.

IMPERIAL OFFICERS' QUARTERS.
(2 Buildings).



Photo-engraved & printed at the Photo-Mechl. & Litho. Dept., Thomason College, Roorkee

PROVINCIAL OFFICERS' QUARTERS.

THE MADRAS FOREST COLLEGE.

This Institution, the buildings of which were formally opened by His Excellency Lord Pentland, Governor of Madras, on the 14th October 1915, is situated about $2\frac{1}{2}$ miles north-west of the Coimbatore Railway Station, in grounds covering about 160 acres.

The following buildings have been provided :—

1. The Main College Building (Plate 30), 247 ft. long by $52\frac{1}{2}$ ft. wide, comprising a lobby, one lecture hall, two lecture theatres, a large physical and chemical laboratory, a preparation room and a dispensary on the ground floor and two lecture halls, a large library, the Principal's office room, two common rooms for the Imperial and Provincial Officers respectively, and a store-room upstairs. The clerks' and record rooms are in an extra wing at the back of the main block.

2. The Gass Forest Museum (Plate 31), situated 100 yards in rear of the College building, is a rectangular structure 145 ft. by $52\frac{1}{2}$ ft., comprising one large room 39 ft. high with a gallery all round and two rooms serving as Curator's room and herbarium at one end.

3. The Imperial Officers' quarters. (Plate 32.)

4. Provincial Officers' quarters—bungalows. (Plate 33.) These quarters are being materially improved.

5. Hostel blocks for students—ten blocks of six rooms each with a common dining room and a kitchen for each block. Each two blocks share one bath-house.

6. Clerical and Medical Officer's quarters.

7. Menials' line.

8. The lodges at the east and west entrances serve as quarters for the Drill Havildars.

9. Engine house for water-pumping plant and gas house.

10. Open gymnasium.

11. Tent godown and store house.

Quarters for the Principal have been sanctioned and construction will begin in April.

KING-EMPEROR'S BIRTHDAY HONOUR'S LIST, 1916.

We are glad to see that the title of "Ahmudan gaung Tazeik ya Min" has been conferred upon Mr. Maung Nyo Dun, Extra Assistant Conservator of Forests, in Burma, as a personal distinction.

CORRESPONDENCE.

TO THE HONORARY EDITOR, *Indian Forester*.

A CLASSIFICATION OF THINNINGS AND INCREMENT FELLINGS.

SIR,—In the February number of the *Indian Forester*, Mr. Howard has suggested the possibility of a standardised classification for India of the different classes of thinnings, which are now and will increasingly be made in "various sized areas of forest which are beginning to be treated under one of the Uniform methods." The main practical object of such a standardisation, as Mr. Howard says, would be to facilitate the explanation of prescriptions of thinnings required, and if it is possible, it would undoubtedly be all to the good. But is a general classification of every kind of thinning required for all methods of treatment and for the silvicultural requirements of all species, practically possible? Is not silviculture one of those branches of science for which the fewest hard and fast rules can be laid down? The definitions of a standard classification for general practical use must surely be exclusively and exhaustively complete? Yet this must mean complication. The definition of each kind of thinning, under a general standard classification, should be applicable to particular prescriptions, called for under different methods of treatment and for different species.

Mr. Howard has suggested a standard classification for criticism. He has used the term "Uniform Methods," and from his next sentence "Thinnings, etc., are already being performed in many of the younger age-classes of these forests,....." he

has presumably used it in a general sense, to include the Selection system. Apply the suggested classification to a prescription for thinning under the Selection system, "Moderate Ordinary Thinning (B grade)." What, if congestion among a group of class III trees is also required to be relieved? No other definition classified is applicable to such a thinning, which is surely very common in Selection forest? This may be added to the definition, but then apply the revised definition to a thinning prescribed for an even-aged crop at a particular age, before the crop has attained its main height-growth, the relief of such congestion may be premature. Again, apply the suggested classification to a prescription for thinning in an even-aged crop, "Moderate Ordinary Thinning (B grade)," under conditions, where here and there a class I tree is outpacing several good even-sized trees round it and will rapidly dominate and suppress them. The prescription of the working-plan requires its removal. Add it to the definition, but the revised definition does not then necessarily apply to a "Moderate Ordinary Thinning (B grade)" under Selection system. The removal of such class I trees is provided for under "Light Crown Thinnings (iii)," but the rest of that definition may not suffice for the prescription. In the younger teak plantations of this Division, I have to carry out just such a "Moderate Ordinary Thinning (B grade)" removing also class I trees here and there, over large areas.

If the suggested classification were to apply only to even-aged crops, which, so far as South India is concerned, are confined to plantations; *Casuarina* plantations, High Forest *Eucalyptus* plantations on the Nilgiris, and Teak plantations in Kurnool, North and South Malabar and Coorg, yet each kind of thinning must be modified according to the silvicultural requirements of each species. Other conditions for the thinning being the same, in the first case it may be advisable to keep trees of classes III and IV, to clean the boles of dominating stems, in the second case they may be kept, simply because they are unsaleable and in the third case it is advisable to remove them, as they are all saleable, are so sensitive to shade that they would be completely suppressed or

dead in a year or two and are not required to cover the soil. One definition for the same thinning would not exactly apply to all three cases.

I have the privilege of some experience of the Nilambur Teak plantations and one of the outstanding features is the extreme sensitiveness to shade of the teak saplings. This, together with the fast growth on good areas, is a very difficult factor in respect of early thinnings. I have heard of it, as propounded as a general rule of silviculture, that the indication of the age at which the first thinning should be made in an even-aged crop is the presence of dominated and suppressed trees. This is not infallible, if applied to these teak plantations. Statistics of sample plots recently collected here show that at ten years old in a good area, originally planted $6' \times 6' = 1,210$ plants per acre, after the first thinning out of 128 trees per acre, there were left 336 trees per acre of which 108 per acre were dominated. Average height of crop 59'. Girth at 4' 6" of Mean Sample Tree 20". The thinning was not heavy but was very difficult, the spacing of the dominating trees being very uneven. Thirty-two fine dominating trees per acre had to be taken out to improve the spacing in the interests of the future crop. Experience shows that the teak saplings on good areas start to form their crown at eight years old and within a year the dominating stems go ahead. There is no doubt that, on good areas, in the interests of the future crop, to ensure more or less even spacing during the first 30 years, the period of main height-growth, the first thinning should be made at seven years old and should be, as far as possible, mechanical, alternate trees in alternate rows being removed. At this age there are some 800—1,000 or more trees per acre, a great proportion of which are already saleable and the growth is so good that dominated trees and even suppressed trees, *if they occur* and if given light, will completely recover within a year or two. Can such a prescription be reconciled with any general standard classification or definition? Of course it is an exception, but it is a "thinning" and might be applicable to other fast growing light-demanders. We come back to this, that each definition

must admit of modification to be applicable to the different thinnings prescribed under particular methods of treatment and for different species.

It seems to me, therefore, that the definitions of any standard classification of thinning should be the result of experience already gained under every method of treatment and for every species for which "thinnings" are now prescribed and would, if considered necessary and practicable, be best arrived at through organised investigation rather than by random criticisms.

Mr. Howard writes that "most countries in Europe and most provinces in Germany have tabulated thinnings in some form or other," but it struck me that there was little consistency in the interpretation of the thinning terminology in Germany, for even there, Herr Forstmeister this and Herr Forstmeister that, never carried out the same kind of thinning in quite the same way under different systems and for different species or even under identical conditions. The definitions of such a classification as suggested, must be elastic under any conditions and surely far more so in India than in Europe.

NILAMBUR :
18th March 1916.

R. BOURNE,
District Forest Officer,
South Malabar.

EXTRACTS.

COMMERCIAL FORESTRY.

We are glad to see the Forest Economist return to the discussion of the commercial side of forest work in India, in the March number of the *Indian Forester*, our regret being that he has not gone at greater length into a subject he is so fitted to throw light upon. The Department can scarcely be blamed for having developed so little of this side of its work in the past, considering it has had to create a scientific forest system out of a

legacy of chaos bequeathed to it 60 years ago. The work of technical organisation is, however, now fairly complete, and there will not be the same excuse in the future if a sound commercial organisation is not now taken in hand. It is inconceivable that a property of this extent in the hands of a commercial company would not by now be yielding enormous profits; but this would have resulted from a totally different policy in its administration. Hand in hand with its scientific conservation and development would have gone a bold policy of outlay; capital would have been put into the property in the form of roads, tramways, ropeways, timber marts and saw-mills, and a host of trained agents would have been on hand to keep producer and purchaser in touch. But there is little use in lamenting what might have been, Government was unwilling to work its priceless property on commercial lines, thinking the purchaser would have relieved it of this duty. He has not done so, and if Government will even now undertake this responsibility it will in another 60 years find that it has tapped a gold mine with the profits of which those of its other great property, the Indian railways, will not compare. It took some little time to understand that money could be made out of railways, and during that time Government was anxious that private enterprise should take the risk and make the money—it sees differently now. To be the possessor of a valuable property such as the State forests, to undertake only the scientific side of its development and to let its commercial development and the profits thereon go to private enterprise would be to betray a great trust. A far-seeing Forester has already suggested running the property by means of forest loans, just as railways are exploited, and to our mind the suggestion could not be improved upon.

Mr. Pearson clearly recognises the need now of a strong commercial side to the service and suggests that outside businessmen be engaged to undertake these duties, leaving forest officers, as before, to continue their work on the technical side only. Except as a temporary measure to bridge the time during which a reorganisation of the Department is being effected, we cannot say we fall in with this suggestion. We should like, on the

contrary, to see a commercial agency established within the Department itself. Look at State Railways : has it not a technical side and a commercial side working together with the greatest success? The Engineering, the Locomotive and the Accounts are the technical departments, the Traffic and Stores the commercial departments. There was a time when it was thought the two latter might be recruited anyhow, but it is not so now, the men in them are being selected for their business qualities, and in the Traffic Department the best railways are now making a further separation between those who look after transportation and those who look after trade. Let us go further than Indian State Railways merely and see what the trend is in connection with specialisation. In the whole field of engineering, whichever the branch be, it is now being recognised that the technical and commercial sides should be kept distinct. The problem is to determine whether to the technical training there should be tacked on a certain amount of commercial training, or the reverse ; whether without adding to present burdens, something should be curtailed from the education in either, leaving this something to be made up somehow by application in later life. To ourselves the best solution appears to be that a clear recognition be made from the beginning of what the career is to be and the training for that career be given. If a man, for instance, is to be a commercial engineer, his technical knowledge of engineering need be only limited while his knowledge must be extensive. Similarly in the Forest Service what we feel ought to be worked up to is a strictly technical branch and a distinct commercial branch, the training for which need not embrace a very detailed knowledge of forestry. This latter branch should be organised in this country and should work side by side with the technical branch, just as the Traffic branch of State Railways works side by side with the Engineering branch.—[*Indian Engineering*.]

TREATMENT OF BAMBOO FLOWERED AREAS IN ANGUL.

*(Extracted from an Inspection Note of the Angul Forest Division,
dated 15th February 1916.*

BY H. H. HAINES, CONSERVATOR OF FORESTS, BIHAR AND ORISSA.)

The *Bambusa arundinacea* flowered over large areas two years ago and there are still standing large clumps of dry bamboos under which the young crop is coming up thickly. West of the Chotkoi village it has not flowered.

This bamboo is of very little value and, on the other hand, it occupies some of the otherwise best Sal-growing areas. It seems to me that steps should have been taken to take advantage of the flowering in order to assist the tree crop and possibly this is not yet too late. There are many deformed Sal which the sudden accession of light has caused to throw up strong shoots, but many of these get twisted and broken off at the junction with the old wood and others are bent by the falling bamboos and, unless assisted, will always be useless. I recommend that some of these flowered compartments, where timber is not being extracted, should be fired at once and a drastic cutting-back be undertaken at the same time. In the rains some of the more favourable localities should also be sown or planted. The rhizomes of the young bamboo are already too strong to be killed by the fire and will send up new shoots. These should be kept under by cutting whenever cutting-back is done until the tree growth gets a decided lead. The operations will need money, but savings are being made on the stoppage of building works and some will be made on the temporary withdrawal of these blocks from fire-protection, and this is a case where, if money is not spent now, the opportunity will be lost. Mr. Ribbentrop, Inspector-General of Forests, in his unofficial note, dated 27th February 1893, considers that the firing of the dead bamboo would cause "an incalculable amount of damage whereas, after five or six years' successful protection, the forest will become more or less self-protecting." I agree that the forest would be more or less self-protecting, but the resultant crop would,

I fear, be the comparatively worthless bamboo. In view, however, of Mr. Ribbentrop's opinion and as results are doubtful, only part of the area should be treated as suggested.

[NOTE.—It is hoped that if the above experiment is carried out, the results will be communicated in due course, so that the experience gained may not be lost, and that the method of burning, if successful, may be applied under similar conditions elsewhere.—HON. ED.]

ROOT-ROT OF CONIFEROUS SEEDLINGS.

Authenticated cases of death of trees from root-rot caused by lack of oxygen in the soil, *i.e.*, from asphyxiation, are not common. Hartig * has described an example of such a condition occurring in young thirty-year-old Scotch pines in Germany, where, according to him, circulation of air in the soil became more and more restricted due to conditions incident to forest growth, resulting eventually in the practical exclusion of air from an argillaceous substratum.

The writer has seen cases, of large tulip trees, *Liriodendron tulipifera*, L., dead from this cause near Lakes Toxaway and Fairfield, North Carolina. Both of these lakes are of quite recent artificial origin, and it is probable that by their formation the water-table in the immediate vicinity was so raised that the roots of the tulips in question were drowned out.

The suffocating effect of piling large quantities of earth upon the roots of trees during building or road-cutting operations is becoming better understood in this country, as evidenced by the increasing number of cases where "wells" are built around such trees in order to provide for the maintenance of an air communication with the roots.

In the diagnosis of tree diseases, one is often tempted, when a visible cause is not apparent, to locate the seat of the trouble in the roots. But in large trees an examination of the roots for direct evidence is usually difficult. With young seedlings, however, the case is different, and on this account the trouble about to be described in this paper deserves notice.

* Hartig, *Text-book of the Diseases of Trees*, pp. 276—278, Eng. Ed., 1894.

The disease in question appeared in the nursery of the Yale Forest School during the spring and early summer of 1914 and was particularly destructive. Besides the loss of about twenty per cent. of a bed of one-year-old red pines, *Pinus resinosa*, Ait., and five per cent. of a bed of one-year-old white pines, *Pinus strobus*, L., several thousand two-year-old red pines succumbed, as well as a few seedlings of one-year-old hemlock, *Tsuga canadensis*, (L.) Carr.

The disease first became noticeable through a dark red or reddish brown colouration of the tips of the leaves. In the initial stages the contrast of this dark red colour with the remaining deep green of the leaves was very striking. By slow degrees, extending over an interval of several weeks, the red colour extended throughout the entire leaf to its base. Subsequently the reddish hues changed usually to browns, or yellow-browns, and the final colour was, in most cases, some shade of yellow, although often intermixed with reddish tints.

A long period—at least a month—was required for this sequence of colour changes; and, at the end of this time, in case the disease had proved fatal, the whole plant was stiff, dry, and entirely dead.

When the disease was first critically examined early in May, it was suspected that the leaves had sustained a fungous trouble of the nature of the well-known *Schütte-krankheit*, both because of their discolouration as well as from the fact that the diseased plants appeared to be located in more or less irregular patches scattered throughout the beds. However, examinations of the discoloured leaves, even on plants where the disease had progressed far, failed to disclose any fruiting bodies or mycelium of a fungus, nor did incubation succeed in bringing to light any pathogenic form.

It was evident that the patches of diseased seedlings were almost always situated in slightly sunken portions of the beds, as well as along their margin, where drainage was poorest.

Diseased seedlings which had been carefully uprooted revealed a root system that was almost without exception entirely dead. This was the case even when the leaf discolouration had not yet

started in, the only evidence of trouble being in the failure of the terminal bud to unfold and develop the leaves of the year. These conditions, joined to the fact that where the discolouration had appeared it uniformly commenced at the *tips* of the leaves, clearly indicated a root trouble of some sort.

That this root trouble was not of fungous origin, but was due primarily to unfavourable soil conditions, was borne out by the following considerations :—

1. Repeated attempts to isolate from the roots a pathogenic fungus or fungi as causal organisms were always attended with negative results. These experiments consisted of (1) incubation in moist chambers, of roots which had recently died, (2) insertion of the inner portions of diseased roots removed with a sterile scalpel, in nutrient agar, and (3) placing such roots, whole, in nutrient agar. In every case no forms appeared except saprophytic fungi, and bacteria which were presumably saprophytic. One fungus which was kindly identified by Mrs. Flora W. Patterson, *Cylindrocladium scoparium*, Morgan,* was of such general occurrence that it was viewed with suspicion, but inoculations of healthy seedlings in sterilised soil with this form gave only negative results.

2. The soil of the seed-beds was stiff and clayey, and although a considerable amount of leaf mould had been added to it, there was still a very small proportion of humus. As a consequence its porosity was slight, and in rainy periods the water would stand for some time in the hollows and poorly-drained parts. Such conditions would naturally prevent a free access of oxygen to the roots, and would therefore readily promote root-rot.

3. The disease caused most havoc during the months of March and April, when the soil was still soggy from the winter freeze and rains, and when the roots, on the other hand, stood in the greatest need of oxygen for the commencement of metabolic activities incident to the season's growth.

4. In June and July, when the soil conditions were much improved over those of early spring, many cases of recovery from the disease were observed, as shown by the fact that new roots

* Morgan, A. P., *Two New Genera of Hyphomycetes*, p. 17 : 190—192.

had developed in the region of the root collar. At this time seedlings which were recovering and forming new roots could be detected very often by a glance at the tops. If these were starting a belated growth, inspection of the root system in every case would reveal usually one or sometimes more new roots, conspicuous by reason of their white colour, their thickness, and origin high up, near the base of the stem. Such recovery, which was of fairly common occurrence, is more in line with a physiological trouble, than a disease caused by a parasitic fungus.

5. The course of the disease was slow, requiring at least a month for its completion. In many cases, even after three months of growth, *i.e.*, about August, the tops still appeared healthy, although the year's growth had not developed and examination of the roots showed them to be apparently dead. Here a considerably longer period would have been necessary before the plants entirely succumbed. A very gradual death of this sort would not be expected if the trouble were due to the attack of a parasitic fungus.

6. In soil of a similar character, in another part of the nursery, which had been thoroughly limed, and contained a generous amount of humus, such a disease had never been known to occur. This soil was loose and porous—never retaining water on its surface for any length of time.

The conclusion is, therefore, that the disease was due to lack of oxygen trouble in a soil which was saturated with water, *i.e.*, that the roots were suffocated.

As already intimated, the remedy would consist in a thorough liming of the soil. Probably this in itself would be sufficient, but the addition of more humus would also improve the physical character of the soil as well as benefit the plant growth directly.—

[ARTHUR H. GRAVES in *Phytopathology*, Vol. V., No. 4, p. 213, 1895.]

PRICKLY-PEAR.

The question of treating prickly-pear in such a manner as to make it suitable fodder for cattle seems to have been dealt with in a practical way by the Bombay Department of Agriculture. The problem was to get rid of the spines of the plant by some less expensive method than cutting by hand; and liquid flame has proved to be the best agent. We know how this has been employed in the present war; but its use in the peaceful field of agriculture came before the days of "frightfulness." In Texas great success was gained by a "pear-burner" and one of these was tried in 1914-15 in the Bombay Presidency. The burner is described as a 2-gallon vessel from which a metal lance-tube leads to a vapouriser four feet away. An air-pump is attached to the vessel which is filled two-thirds full with petrol. Then air-pressure is applied by the pump and the petrol is driven out of the vapouriser. When a light is applied a jet of flame is projected and the prickly-pear is sprayed. The spines only are burnt off and the plant itself is not damaged. The cattle have to be taught to feed off the pear after treatment, but presumably this is a simple matter. The official verdict is that the burner promises to be invaluable in the case of a fodder famine in the East Deccan, and as its cost is only Rs. 68-2-0 landed at Poona wide employment seems possible. Great care has, of course, to be exercised owing to the inflammability of petrol, but an intelligent cultivator should readily learn to handle the machine with safety to himself.—[*The Pioneer*.]

CACTUS GUM.

New wealth from the desert, in the form of some valuable cactus product, is being looked for at the University of Washington. A quantity of dried cactus contains much resinous material, the properties of which are to be fully investigated. Whether the material is a true gum, soluble in water, or a resin, soluble in turpentine and alcohol, was not known at the outset of the experiments.—[*Capital*.]

FORESTRY IN INDIA.

ENTRY INTO THE SERVICE.

Sir Sainthill Eardley-Wilmot, K.C.I.E., writes in the *Indian*—

The Indian Forest Department has been reorganised during late years, and now presents to the youth of the Empire much greater attractions than in the past. It has survived half a century of neglect and opposition, during which its members suffered from isolation in unhealthy districts, wretched pay and poorer prospects, and has now reached a stage when fuller recognition is given to those who are managing a vast and well-organised estate intimately connected with the agriculture and industries of the country.

The extension of railways and the increase of population has remedied to a great extent the loneliness of the past, and the opening up of the forests and the construction of roads, houses and wells have so improved the sanitary conditions that, apart from the slight risks always facing the pioneers of civilisation, the forester, as a rule, is not called upon to endure greater hardships than his fellow-workers in other branches of the Civil Service.

As to salaries, the Indian forester now begins his career on pay and allowances which enable him to live in comfort and independence, while the system of annual increments of pay ensure that, provided he behaves like a gentleman and is an efficient forester, he will be in receipt of a salary of £1,000 a year before he completes his twentieth year of service. During the whole of that period, and thereafter, his professional success must depend on personal energy and ability.

The complaint that the forester in India is denied the interest of real professional work is no longer valid. He will find that the forests in his charge are managed in terms of carefully prepared working-plans, or that he is employed in compiling new plans or revising those about to lapse. He will discover that he has to puzzle his brains to some extent if he proposes to teach his seniors anything in the way of silviculture, transport, contracts or utilisation, and his patience will be sorely tried in administering the records-of-rights and in remaining in sympathetic touch with

the neighbouring inhabitants, on whose good will largely depends the success of his operations.

Should the forester's leaning be towards the sciences cognate to the practice of his profession, his attention will be attracted to the Imperial Research Institute at Dehra Dun, where special opportunities are afforded for the study of chemistry, entomology, botany, engineering, etc., and whence issue from time to time the results of forestry research in India in the form of memoirs, bulletins and records. There also, if his interest is awakened in forestry education, he will be able to make acquaintance with the system adopted for the training of Indians for the service. In short, on arrival in the country he will find himself attached to a forestry organisation superior to anything in the Empire or its dependencies, and which should become, by the exertions of the men now joining, at least equal, if not superior, to anything of the kind in Europe.

Of hobbies, sports and pastimes connected with a forest life it seems unnecessary to write, for the forester will select these according to his taste. When indulged in the proper spirit they add to his power of observation, take him to localities perhaps otherwise neglected, and bring him into more familiar contact with the people. They may also ultimately create in him an absorbing interest in botany, entomology or other speciality which may be of the greatest advantage to his professional worth.

PROSPECTS.

The advantages recently conferred on the Forest Department have necessitated naturally a more careful selection of its members. Candidates must have obtained an honour's degree in pure science at a University before they can appear before the Selection Committee which sits yearly at the India Office. After selection they must specialise in forestry at a University approved for this purpose by the Secretary of State for India—at present Edinburgh, Oxford or Cambridge—and obtain either a degree or a diploma in forestry, according to the system adopted by the institution selected. Practical training has been carried out in the past

partly in this country and partly on the Continent. It is hoped that it may be possible in the future to eliminate Continental training when State demonstration areas are fully organised at home, more especially as present conditions on the Continent enforce this step whether home organisation is complete or not. It will be unfortunate, however, if visits to Continental forests continue to be impossible, not because the methods there adopted can be slavishly copied in India, but because the forester may learn how to apply some of the unalterable rules of silviculture to those Indian conditions to which he must conform whether his work takes him to the north, south, east or west of the peninsula.

The choice of a University in which the candidate for the Indian Forest Service will commence or complete his special education depends largely on his own tastes and on the means of his parents. Edinburgh and Oxford in normal times have each about fifty forestry students on their rolls. Cambridge, on the other hand, attracts fewer. The expenses at Edinburgh are about one-half of those inevitable at the two English Universities, and while Scotland, of course, gives larger scope for practical training than does England, Edinburgh, also, possesses a forestry building with class-rooms and museums on a much larger scale than either Oxford or Cambridge. Of the social conditions each one must be his own judge. Perhaps it would be correct to say that in the north class distinctions amongst students are not so noticeable, and that in Scotland, as on the Continent, a forester receives a special welcome as belonging to a profession in which very many landowners are personally interested.

Finally, to a youth considering a life-long foreign service there are matters of leave and pension of great importance. With regard to the former, the rules are liberal, being similar to those of all civil departments in India. The pensions, however, are inadequate. They culminate in a yearly sum of £525, which may be earned ten or more years before the completion of service, as defined by the age-limit, and thus the attainment of the highest rank in the department does not bring with it, as in other services, an increase of both comfort and dignity. It is true that there is a

provident fund in which an officer may invest a considerable proportion of his salary at good interest and with perfect security, but it still remains evident that an improvement of the pension rules is necessary in order to complete the reorganisation of the terms of service, which otherwise are on favourable lines.

Writing as one who joined the Forest Department in its infancy and left it when the strenuous work of improvement was almost complete, I think it is correct to say that the service as now constituted offers a career suitable to such sons of the Empire who possess self-reliance, are not afraid of responsibility, and desire a fair outlet for their energy and ability. With these ordinary qualifications an Indian forester of the present day may lead a life free from financial worry and full of interesting work and relaxation.—[*The Leader.*]

INDIAN FORESTER

SEPTEMBER, 1916.

FOREST RESERVATION IN BURMA.

BY H. W. A. WATSON, I.F.S.

The question of laying down and putting through a strong policy for future reservation with the object of taking in all areas capable of procuring marketable timber that are unsuitable for permanent cultivation and checking the inroads of the taungya-cutter.

A glance at the map of most forest divisions in Burma shows a number of forest reserves of various sizes, and that, these reserves are, for the most part, more or less remote from the more populous parts.

The chief reason for the former appears to have lain in the suspicious attitude of the authorities to reservation and, for the latter, to the boundaries being thrown back in deference to the wishes of the villagers.

Moreover, owing to the value of teak overshadowing that of all other species, it is only in recent years that reservation in the interests of the latter has received serious consideration.

2. In throwing back the boundaries of the reserves in deference to the wishes of the villagers, we certainly have not considered the best interests of the community.

In accessible areas the throwing back of the boundary has resulted, so far as the excluded area was concerned, in the removal of all marketable timber by the trader and the serious depletion of the immature stock by the wasteful use of the villager. Superimpose a trade demand for firewood and areas, that were at one time capable of producing marketable timber, are in a couple of decades reduced to wastes that are only reclaimable at an enormous outlay.

What the result of excluding forests in deference to the wishes of the villagers has been is emphasised by the fact that it is now necessary to seriously consider the question of forming village forests, *i.e.*, within a generation the villagers and traders have squandered the resources of the accessible areas.

3. To turn to the damage by taungya-cutting tribes, little serious effort has so far been made to check their inroads.

The area that has been notified in which taungya-cutting is prohibited is comparatively negligible and action on these lines only tends to concentrate their efforts elsewhere.

The constant pressure of trans-frontier taungya-cutting tribes is a very serious menace. Large areas of higher evergreen and pine forest have been reduced to grass wastes and in the lower levels their depredations have resulted in large areas being overrun by creeping bamboo to the extinction of tree-growth. To classify the remote hill forests as permanently inaccessible is an easy way of begging the question.

We know little about their economic possibilities and are apt to forget that our prehistoric methods of timber extraction are susceptible of vast improvement. Timber transport by airship, a century hence, is no wilder an improbability than was wireless telegraphy a century ago, and while forests may be destroyed within a generation, it takes many generations to replace them.

4. The Forest Officer in the past was, to a great extent, compelled to take too narrow a view, but this view is broadening and the same process of evolution has lessened the suspicions with

which the civilian authorities formerly regarded our operations. In the past we were compelled to reserve in patches and to exclude much of the accessible areas.

Should we continue in the future to allow, without protest, what remains of the unclassed forests to be turned into irreclaimable waste, we shall justly lay ourselves open to the reproach of future generations.

5. As a result of our past policy, the less accessible areas are reserved to a great extent and the more accessible steadily deteriorating, though burdened with troublesome regulations, made in a vain effort to stay their ruin and impossible to enforce efficiently.

6. The only remedy for this state of affairs appears to lie in the reservation of all tracts capable of producing timber or fuel.

In carrying out this reservation all lands suitable for permanent cultivation should be excluded and definite areas should be set aside for such communities as must exist by taungya cultivation.

The settlement might be by townships, or any other suitable unit, and should be carried out on broad-minded lines. To begin with, unnecessary bogies, such as that relating to the use of fire in areas unlikely to be brought under fire-protection, should be eliminated from the proclamation. We should also revise our ideas on the subject of what constitutes trespass by man and beast and modify the ruling, limiting the exercise of rights to the number of houses actually inhabiting a village at the time of settlement.

The area, within a reasonable radius of habitations, should be reserved for management mainly as communal forests, the original inhabitants getting their produce free, and provision being made for immigrants, being so far as possible provided for at privilege rates. The profit on the management of such communal forests should be utilised for the benefit of the villages in their vicinity.

It should not be considered trespass by man or beast to stray within a reasonable distance of a right of way. Above all, the necessity for dealing with unimportant technical offences in a broad-minded way should be impressed on Divisional Forest Officers.

7. The principal arguments that will be adduced against action on these lines are—

- (i) The liability of the ignorant villager to oppression by the local forest subordinates.

This argument is frequently adduced in a vague manner.

There are many villages in exclaves surrounded by reserves that have to depend for all their requirements in the shape of forest produce from these reserves. If subject to undue oppression, the position of the inhabitants of such villages would be intolerable and they would migrate elsewhere. I have always found the inhabitants of these enclosed villages contented and independent. Certainly the inhabitants of the larger groups of villages are not so unsophisticated as to tolerate oppression.

If, however, this argument is considered serious, the remedy would seem to lie, in the case of portions of reserves managed mainly as communal forests, in vesting either the senior headman or a responsible elected representative of the community with the position of forest subordinate.

- (ii) That the Forest Department is not sufficiently staffed to manage the increased area of reserves.

The remedy for this rests with Government. Under our present system of management undue stress is laid on revenue production to the exclusion of local interests. A 60 per cent. actual profit is expected from the forests instead of a legitimate 33 per cent. Whatever increase of staff is requisite will doubtless be provided in time if the matter is properly represented. We must, moreover, bear in mind that our subordinate staff is progressing both in capacity and in morale and that by abolishing the unclassed forest in favour of reserves we concentrate our energies on one group, waste land subject to few or no restrictions being substituted for our present unclassed forests with their numerous rules and regulations. Some very simple scheme of management will suffice for the areas to be worked as communal forests and by giving the village headman some authority in the management we increase his prestige and enlist his co-operation. The main point is to confine the operations of the trader to areas where they will not

interfere with the satisfaction of the legitimate demands of the villagers.

8. The question of allotting adequate areas to the taungya-cutting communities will undoubtedly present difficulties. Even employing the liberal formula, *viz.*, number of households multiplied by average area cultivated per household, multiplied by average rotation, and doubled to allow for land that is unsuitable for taungya-cultivation, judging by past experience it will be found that the communities, if left to themselves, will largely squander the resources of their areas in little over a generation, owing to their improvident patchy methods of cultivation and the unrestricted use of fire.

A visit to the south-west part of the Southern Shan States will show that, in cases of congestion of population, the taungya-cutting communities have adopted one of the following alternatives :—

- (i) Terraced cultivation.
- (ii) Burning of the soil mixed with cow-dung.
- (iii) Fire-protection.

This last is particularly interesting and has been in force on their own initiative in the case of some of the Karenni tribes for many years. Experiments as to the best methods of taungya-cultivation, where the area is restricted, might, with advantage, receive the attention of the Agricultural Department.

The solution will probably lie largely in fire-protection, combined with a division of the area into blocks to correspond with the number of years in the taungya rotation. This solution, when arrived at, should be enforced by law.

9. It seems obvious that only by some such system of universal reservation of all forests of value can the present waste be stayed and the declared policy of Government, as laid down in Circular No. 22F., dated 19th October 1894, be carried out.

No system of reserving patches as fuel and fodder reserves will suffice to meet the growing demands of local communities. A perusal of the literature on the subject shows that past efforts in this direction have proved futile.

10. By systematically taking action we resolve the classification of Government land into—

- (i) Reserved Forests (Commercial and Communal).
- (ii) Waste land of no commercial importance, including absolute waste and areas abandoned to the taungya-cutter.

In the case of the latter group, it may be necessary to accord some protection to trees along roads, streams and within municipal areas ; but otherwise, these should be abandoned absolutely.

11. If these views are accepted, the most urgent townships or other units should be taken in hand without delay and in divisions, where further reservation is urgent, instead of adding the customary patch, the whole township concerned should be notified and dealt with. Wholesale reservation at one time will be found less disturbing to the villagers than the addition of patches at intervals.

12. To conclude, it would seem that it is the duty of the Forest Department to represent strongly and continually the great waste of the forest resources that is going on and to press for remedial measures. Should Government not see its way to legislate for these, the responsibility no longer rests with the Forest Department. The longer the delay, the greater the stretch of irreclaimable land that will accrue and remain as a reproach to the administration.

NOTE ON FOREST POLICY IN BURMA.

BY J. W. A. GRIEVE, I.F.S.

A very large percentage of the Province consists of ranges of low hills and valleys, which are, owing to their steepness, want of soil and so forth, usually unfit for the production of permanent field crops. A large proportion of these areas has already been taken up as reserved forest, but much still remains as so-called unclassed forest, that is, waste land, often uninhabited, or at most containing a few scattered villages. It is with these "Unclassed forests" that this note is more immediately concerned. Apart from conditions of climate or other local peculiarities which must

be dealt with on their merits, it may be safely laid down as an axiom that the interests of a country will be best served by producing from each class of soil that crop which will bring in the largest permanent return. Many of these unclassified forests contain much valuable teak, while a still greater number contain timbers which only require to be placed on the market at a reasonably low cost to ensure their ready sale at remunerative rates.

It is, therefore, obvious that they will eventually prove a very large source of revenue to the country, and as such should be preserved against destruction : for it is inconceivable that in such broken country any known crop could profitably replace the forest. The factor most urgently required for their development, as for that of the country generally, is an increase in the labouring population. To secure this object, and at the same time to utilise, to their fullest extent, the vast sources of forest capital contained in the Province, must be the key-note of whatever Forest Policy is ultimately adopted in the country. These unclassified forests are gradually being examined with a view to their reservation, but owing to the ludicrously inadequate staff of Forest Officers in Burma, progress in this direction is necessarily extremely slow. Under present conditions, villagers are given every inducement to settle in such areas. They can take up any land and cultivate it as they please. Some form of taungya cultivation is usually practised. In forming forest reserves, the practice is to exclude a very considerable area of land usually incapable of carrying any permanent crop other than forest, in order that any existing village may obtain its domestic requirements free without entering the Reserved forest ! That such a policy can exist, gives one furiously to think ! We take up enormous areas of reserve, which contain millions of tons of unsaleable material of the kind required by the population, and we prevent that population from using it. On the other hand, we deliberately give over to the villager large areas of ground unsuited to the production of any crop other than forest with the knowledge that, in the course of time, he will render them unfit for any purpose whatsoever, including the production of the very material, the supply of which the land set aside to provide ! It

therefore appears obvious that the reserved forest does not usually attain the object described in paragraph 2 of Appendix V of the Indian Forest Code, 7th edition, which defines the objects of administration of State forests, any more than does the permission to destroy certain areas of unclassed forest permanently provide for the supply of the domestic requirements of the villager. There can be no doubt that such a policy is inherently a bad one. Owing to the vast areas still unpopulated, its evil effects are so far negligible, but with any marked increase of population a day of reckoning will be bound to come. Every village will be surrounded with an area of unproductive scrub and will eventually have to seek its requirements from the Reserved forests. What is wanted is a system by which all land, which can only profitably support a forest crop, would be permanently set aside for that crop, provision at the same time being made for the wants of a labouring population sufficient to work it. It is a recognised fact that tea, coffee, rubber or any other agricultural estate, must have a sufficient labour-supply conveniently situated to work it. In the case of forest estates, which cover enormous areas, this is even more essential, and the obvious method of providing it is by means of forest villages situated at convenient intervals throughout all reserves.

The lines, on which such villages are run, vary greatly with local customs and peculiarities, but the main principle is, that the villagers are given land to cultivate free of charge or at a very low rent, and free forest produce for all domestic requirements, in return for which they give so many days' labour on forest work free or at reduced rates. They are exclusively under the Forest Department who, of course, are responsible for the carrying out of the ordinary laws of the country. The villagers are given cultivation sufficient to produce food for their own consumption, and during the period when no field work is possible they do all the road work, thinnings, fire-protection and so forth, for payment as may be agreed upon. Moreover, in the forest village lies the solution of the much-vexed taungya question. The taungya-cutter is like a forest fire,—he is a bad master, but, under control,

he is the best servant the forest can have. Large permanent villages are of less use than those which can be moved from time to time to different work centres, and it ought to be possible, by means of some system of controlled taungyas, to effect the planting up of the whole forest at a minimum cost, and in such a way that by the end of the rotation, the first year's plantations should be ready for felling over again with the subsequent repetition of the taungya process. That this is an ideal that will take many years to work up to must be admitted. The enormous tracts of land still remaining unsettled, the incorrigible laziness of the Burman, and the corruptness of the subordinate staff are all factors that militate against the successful working of such a scheme. Greater even than any of these is the want of controlling staff. Until this is remedied, little or no progress in forest development can be expected, and for so long will the colossal wastage of forest capital of, perhaps, the finest forest property the world can show, continue. The war has of course set things back in these as in most other respects, but it has not been responsible for what must be held to be a wrong policy. Prompt measures to revise this at least can be taken. The longer it is put off, the greater will be the destruction of forest capital, the larger the denuded areas which tend to become worthless and the greater the inconvenience to the settled population. That the forest staff is now numerically insufficient to deal with the areas already under its control is no argument against the preservation of valuable forest from destruction. The other branches of Government Service are equally short-handed and consequently equally unable to administer these tracts. On the other hand, the idea that a reserved forest is an area hermetically sealed against the supply of all local demand or against the ingress of the labouring population it so urgently requires, must be thoroughly grasped by forest official and villager alike.

PRIZE-DAY, FOREST RESEARCH INSTITUTE AND
COLLEGE, DEHRA DUN.

The Annual Prize-Day of the Provincial Service Class was held on the 10th July at the Forest Research Institute, Dehra Dun, in presence of Mr. Hart, Inspector-General of Forests.

The proceedings were opened by Mr. B. B. Osmaston, who read the following report :—

“MR. HART, GENTLEMEN,

The Members of the Provincial Service Class who are now about to leave us are the third batch trained under the new conditions.

The class is a small one, consisting of eight men only.

Their course of studies has extended over full two years, during which period, in addition to lectures in the class room, they have spent 14 months on tour, including two in South India. On these tours practical instruction was given in Engineering, tree-marking, Sylviculture and the framing of Working Plans.

I am glad to be able to say that the class, as a whole, is the best we have had.

Even the man at the bottom of the list has succeeded in getting 70 per cent. of full marks, and the top man has got the very creditable total of 82 per cent. Four out of the eight have got more than 75 per cent. of full marks, thereby obtaining “Honours,” and the rest are awarded the ordinary Pass Certificate. These good results are no doubt largely due to intelligent and sustained application, but also partly to the fact that owing to the smallness of the class, the Instructors were able to give the students an unusual amount of individual attention.

The conduct of the students has been good.

Their health, on the other hand, has not been quite satisfactory.

The members of the class have all shown considerable keenness at games, but with a single exception, they have not greatly distinguished themselves in this line.”

The following is the list showing the order of merit and the winners of the various prizes :—

CERTIFICATES.

1. Sochindra Nath Mitra (Bengal).	}	Honours Certificates.
2. Muhammad Abdul Hafiz (Madras).		
3. Rajendra Nath De (Assam).		
4. Anil Kumar Adhikari (Assam).		
5. Jai Krishan Nanda (Kashmir).	}	Ordinary Certificates.
6. Troilokyanath Hazarika (Assam).		
7. Puranic Krishnaswami Rau (Mysore State).		
8. Roland Harry Mitchell (Madras).		

MEDALS AND OTHER PRIZES.

Gold Medals.—For Honours Certificates.

Hill Memorial Prize (best in Sylviculture).—S. N. Mitra.

The Indian Forester Prize. For general proficiency.—S. N. Mitra.

The Hon'ble Member's Prize. Most promising student.—R. N. De.

Inspector-General of Forests' Cup. Best all-round athlete among outgoing students.—R. H. Mitchell.

Silver Medal. (Forestry) ... M. A. Hafiz.

Do. (Botany) ... S. N. Mitra.

Do. (Surveying) ... A. K. Adhikari.

Do. (Engineering) ... R. N. De.

Championship Cup. Winner of most events in the athletic sports (all four classes).—R. H. Mitchell.

The certificates and prizes were distributed by Mr. Hart, after which he gave the students the following address :—

"STUDENTS OF THE PROVINCIAL SERVICE CLASSES,

In the first place I have to say a few words to those of you who have now completed your training and are leaving the Research Institute. I am glad to hear such a good report from the President about you. None of you have failed to obtain a pass certificate and the proportion of Honours men is unusually high. You have

evidently worked hard and well and, in addition, have been fortunate in that, being a small class, it has been possible for your Instructors to give you more individual attention than usual.

This is probably the last year in which the Provincial Service students will have their prize-day in July. In the first place, the finish of the course at this time of the year means that the final examinations are held at about the worst season of the year and this is hard both on the students and on the staff. Then, as long as we have the Ranger class with us, it seems desirable that there should be one joint prize-day for all the students of the Institute and College combined and not two separate functions, neither of which has been a very impressive ceremony of late years. So next year we intend to have a combined prize-day at the end of March. This will necessitate curtailing the length of the Provincial Service course for the years 1915—17 and 1916—18 to 21 months, which is unfortunate but cannot be helped.

It would not be quite true to say that every one of you has received a prize, but still I think it must be admitted that for so small a class the number of prizes given is large. Among these prizes were four valuable gold medals. In this matter your successors will not be quite so fortunate as you have been. The Board of Forestry considered this question at their meeting held last March. They decided that in future only one gold medal should be given to the man who holds the first place at the end of the course of training, provided that he also obtains an Honours certificate, and I think I may say that the Government of India are likely to accept this recommendation. You must not think that in making this proposal the members of the Board of Forestry were guided by reasons of economy only. They thought that gold medals were becoming a little too common and that it would be a much greater honour to be the one gold medallist of the year than to obtain a gold medal under present conditions. The student who secures the gold medal under the new rule will be a marked man throughout his service to a much greater extent than the holder of a gold medal is at present.

As a class you have done exceptionally well at the Institute, and I hope that you will all continue to work hard and honestly during your service in the department. If you do, you have excellent prospects ahead of you : but you must remember that those prospects depend on your future work in the jungles and not on the work, good though it is, you have done in the course of your training.

Those of you who remain with us either for one or for two years more will have the advantage of living under pleasanter conditions than your predecessors during the time you spend at Dehra Dun. Through the energy displayed by the Executive Engineer, Mr. Jones, the new buildings are now ready for occupation and you will all live together in comfortable well-found quarters. By next year you will have a fine playing field of your own with ample room for cricket, football and hockey. I hope that under these conditions you will all take a real interest in athletics generally. You must remember that health and strength have a great deal to do with the successful career of a Forest Officer. You have to build up the athletic records of the Provincial Forest Service classes and, in addition to your work, I expect to see you take a keen interest in making and maintaining those records as high as possible.

Government has provided a commodious club house for the students. It is not very well furnished at present, but that will be seen to gradually. I want you to understand that for the rest of the club fittings and property you must depend on yourselves. It is obviously impossible that the club house should be fitted out completely at the start, and indeed it is probable that if this was done for you straight away the club property might not be treated with very great respect. For the next few years, therefore, you students must be content to do as the Forest Officer has to do throughout his service, that is, to work for the benefit of posterity. I think, also, that the future of the club house should not be regarded as the business of the European and Anglo-Indian students only. The club house will be used as a sports pavilion and for this purpose and as a reading-room, etc. it will be open to

students of all denominations. To some extent, therefore, it should be supported by all the students. It should, indeed, be regarded as a general club which all are entitled and expected to use and support and in which those who live in European style will also have their meals."

THE NORTH KAMRUP GAME SANCTUARY, ASSAM.

BY A. J. W. MILROY, I.F.S.

To be in charge of a Game Sanctuary is a piece of luck that comes to few, and an account of what is being done in this Province to preserve the fauna of the country may be of interest. Not so many years ago, Sir Harry Johnstone severely criticised the Government of India for its indifference on the subject of game preservation, but Assam had already established a number of sanctuaries, and since then a Game Association has been formed in one of the Tea districts for the purpose of managing certain shooting preserves in conjunction with the Forest Department. The Kamrup Sanctuary, of 57,600 acres, was gazetted a Reserve in 1907, the main object in view being the saving from extinction of such *rhino* as still survived locally. It is situated in the extreme north-west corner of the district, bounded on the west by the Monas river, on the north by Bhutan, and on the east and south by waste land, so that its reservation inflicted no hardships on any of the inhabitants of the district. Across the Monas is another Sanctuary under the D. F. O., Goalpara.

The south portion of the Reserve is chiefly swamp with higher grass lands in between, a nasty treacherous piece of country, which seems to have become more water-logged since the earthquake of 1897. *Acacia Catechu* and *Albizzias* are sprinkled over the grass savannahs.

The central portion is alternating prairie and dense moist evergreen forest, containing almost impenetrable patches of cane : some of the more interesting trees are *Morus laevigata*, *Amoora spectabilis*, *Cedrela Toona*, *Duabanga sonneratioides*, *Cinnamomum glanduliferum*, *Artocarpus Chaplasha*, etc. The north portion

slopes gently up to the Himalayan foot-hills, and consists of grass afforested, often rather sparsely, with deciduous and fire-resisting species such as *Acacia*, *Albizzia*, *Gmelina arborea* and various *Bauhinias*. On account of the remoteness of the Reserve from any market the present demand for timber from it is practically nil.

There were formerly three favourite shooting grounds for rhino in this part of Kamrup, and two of these have been included within the Sanctuary; the third was omitted, possibly because all the rhino had been shot out, but as they are again to be found there now, the Local Administration has been asked to sanction the reservation of the area as an addition to the Sanctuary, as it is uninhabited and, for the most part, undrainable swamp.

There can be no doubt that Government acted none too soon on the rhino's behalf. His horn and flesh are of such value to Hindus that a number of local shikaris made their livelihood by killing rhino, and, but for the thickness of his skin and wonderful general vitality, and the poor quality of the shikaris' powder, there would be no rhino left alive here to-day. I have heard of 17 native bullets being dug out of a dead rhino, some of which must have been in him for years.

While it is a desperate animal to attack on equal terms, it is easy game to the pot-hunter on account of its habits of using the same tunnels through the grass and of depositing its dung in the same places, so that, given a properly placed *machán* and patience, success is bound to come sooner or later to the happy shikari.

Europeans and native sportsmen using elephants also did the stock great harm by shooting an undue number of cows, and there are many men who can show trophies from cows and none from bulls. The sexes are so similar in appearance that no one can be blamed for making mistakes on this score; the mischief was done by following up family parties of rhino. A bull and a cow with her calf are commonly found together, and on being disturbed the bull generally clears out at once, leaving the cow to face the danger while her calf makes for safety. As a rule, under these circumstances, the cow asks for trouble by charging her pursuers bald-headed, and consequently usually gets it in the neck. Another

annoying habit the cow rhino has is that of leaving her calf in some hidden place while she goes off to graze, so that any one coming on her track thinks he is after a solitary bull, until after a time the calf chips in unexpectedly.

The Sanctuary has only once been invaded officially, when Lord Minto shot here in the beginning of 1909.

His action created a considerable amount of resentment amongst the Europeans of the Province, and it is only fair to say that he had been completely deceived as to the state of affairs. His information was that this Sanctuary swarmed with rhino, and that there were none outside, and by the time that letters appearing in the Press had undeceived him on this point, the whole *bundobust* had been made and the shoot had to go on as arranged.

No one could accuse Lord Minto of not being a sportsman, and, as soon as he understood that he had been misinformed, he promptly limited himself to the bagging of one rhino, and did not allow his suite to shoot at all.

He got his one rhino but only after a deal of trouble. Rhino are difficult animals to drive at any time, and on this occasion the beating arrangements were not in the hands of the then D.F.O., Mr. D. P. Copeland, who knew the locality inside out, or of any one with local knowledge. Attempts were made to drive the rhino by *force majeure* (as represented by over 70 elephants) in directions that they did not wish to go. Now the rhino is not an animal that allows itself to be put upon, and what happened over and over again was that a rhino disturbed by the advancing elephants would trot out, survey the long line and then charge with its unearthly burbling at what appeared to it to be a weak link in the chain. The line as invariably broke, for the elephant that will face a rhino is a real rarity, and much time was lost in getting the quaking 'hathis' (elephants) back into line for a further advance.

One elephant, caught as it was turning round to bolt, was bowled completely over by a rhino. A well-known staunch tusker was in one beat posted as a stop, but had the bad luck to be in the way of a particularly irate cow, which, with its half-grown calf, was not in any mood to be stopped. The old tusker, somewhat

surprised not to hear the expected bang from his back and see the evil beast swerve off, had to do something for his reputation, so he bravely pinned the cow down with a tusk on either side of her neck, but the calf starting to slash him from behind he had to release the mother from Chancery and fly for his life.

As most people know, the offensive weapons of the Indian rhino are his tushes and not the horn, and, I must say, it is a fearsome thing, if one has time to look back, to see the open red mouth with the wicked tushes close behind one's elephant's heels.

I can never understand why those who manage shoots for Princes and Viceroys always aim at driving all the game to them; perhaps it is to guard against blank days.

If any one wants excitement without undue personal risk, he can always be sure of getting it by following up a rhino on an elephant, whereas it must be difficult to fail to down a poor old rhino driven up to one in the open. There were considered to be 15 or 16 rhino in the Sanctuary at the time of Lord Minto's shoot.

Arrangements had been made to hold a census during the cold season just over but, on account of men joining the Officers' Reserve, I was given charge of a second Division and had to postpone operations. We do not mean to try and count every rhino in the place, but only the cows with calves. The enumeration will be done by taking very careful measurements of the foot impressions. If, as I hope and believe, we find that there are indisputably as many as 12 cows with calves we can afford to feel confident as to the future of the stock, as there would be a number of immature cows and cows about to calve, but without a calf at foot, not reckoned in our total.

Rhino shooting is now forbidden in Assam except with the Chief Commissioner's permission, but advancing civilisation and more especially the graziers' herds are opposed to any increase of the species outside Reserves. Although the rhino individually is a sturdy and independent beast, yet, as a species, it is easily discouraged and does not appear to thrive, except under conditions where it is not disturbed.

There is every hope of the rhino in the Reserves increasing considerably in numbers. It is a slow breeder and the areas set apart for it are necessarily so confined that I doubt if it ever will get plentiful enough again to become a regular beast of the chase, but we hope that it will so increase as to permit us to catch calves for zoological specimens, either by pitting or in some other way. Considering that a man can sell a dead rhino, horn, skin and flesh, for nearly Rs. 400, poachers are obviously tempted to have a go at them, and rhino shooting and illegal elephant hunting are the only forms of poaching that we have to consider seriously : deer are common enough outside. Rhino, undoubtedly, are occasionally killed in Sanctuaries. In Goalpara raids are sometimes threatened by truculent Nepalese from Bhutan, while those Sanctuaries that have the Brahmaputra as one boundary are obviously very difficult to keep inviolate : in fact, a Conservator a few years ago had to deal with a case where a forest guard had helped to kill a rhino.

The Kamrup Sanctuary is fortunate in its boundaries, and there are not, as yet, any Nepalese across the border in Bhutan. The whole *bundobust* for killing an animal and disposing of the loot has to be so complicated, except in cases where there is access to a foreign country or navigable river, that a number of people must be in it and some one is sure to give it away, even if too late to do any good. The only reported case in Kamrup occurred recently when some right-holders say they found a dead rhino. Investigations are being made to see if it was a case of lead-poisoning. Provided that we are sufficiently generous in rewarding those who supply us with information, there is no reason to fear that this sort of poaching will increase.

There were rumours some years ago that elephants had been caught in the Sanctuary, and a tusker was certainly shot by a party of Bhutanese. In consequence of a complaint made to the Bhutan authorities, soldiers were sent to the offending village and carried off eight out of the ten village muskets, and they evidently played the part of the brutal and licentious soldiery so well that elephant shikar in British territory is no longer considered worth while.

The Game Sanctuary is opened, in its turn, to elephant catching, and Kheddah operations will be allowed during 1917-18 and 1918-19, thereafter remaining closed for eight years. Like all elephants from the north bank of the Brahmaputra, the North Kamrup elephants have a reputation for hardiness, said to be due to the long distances to be travelled between feeding grounds, and the dry nature of the food; South Bank elephants are supposed to be softer on account of the grazing being more plentiful and lush.

The large spectacular Kheddahs, as run by the Mysore Government, and formerly by the Kheddah Department, are not seen here. In them more than one herd may be surrounded and retained by an army of men, while the stockade is run up, but here we build our stockades at the end of the rains, and then, when a herd has been located in the right direction, it is driven up the path on which the stockade has been erected.

In many places in Assam, salt-licks take the form of gigantic amphitheatres carved out of the hillsides and approached by narrow entrances, so that often little more needs to be done than put a gate in position to turn the lick into an economical form of elephant trap. Elephants, naturally, will not allow themselves to be driven into a blind alley like this, but a watch is kept from *macháns*, and the gate is closed on any herd that enters of its own free will.

Elephants seem to be especially fond of visiting the 'poongs' (as the Assamese call salt-licks) in February and March when the weather is hot; the earth has a purgative action. Rhino do not care very much about salt-licks, but all the other herbivora seem to appreciate them. Imperial and green pigeons are attracted in great numbers to a certain salt-lick further east in Darrang district, but it is not known what is the special attraction there. Bright sunshine is apparently necessary to extract the virtue from the earth, as the birds at once leave off pecking at the face of the cliff, if the day clouds over. The Imperial pigeons have a wallow of their own in this 'poong,' a depression filled with whitish mud, in which the birds bathe with great enjoyment.

The same country in the Sanctuary that is good for rhino is also well suited for buffaloes, and 30 years ago vast herds were to be found. Buffaloes are distinctly scarce at present, and the great diminution in their numbers is largely ascribed locally to the form of shikar employed by certain native shooting parties, who used to surround whole herds with elephants and wipe out the lot. It sounds impossible that any one could take delight in such unsavoury slaughter, but I am afraid it is true.

The Assamese believe that tigers prey heavily on buffalo herds but not so much on *mithun* (or bison). Considering the strength and ferocity of the buffalo this might appear to be incredible, but there is probably something in it. Roosevelt in his book on "African Shikar" states it as a well-known fact that lions in some places live by preference on the buffalo herds, so that there is nothing of the impossible about the more powerful tiger doing so in this country.

Not so very long ago a planter told me that when he was out one evening with a friend, they came on a herd of buff and were sitting on their elephants watching them, when suddenly a tiger came charging out of the jungle towards the herd. They each fired two barrels at him but missed, and the buff and tiger ran off. Thinking the *tamasha* was all over, the two spectators were moving off homewards when they heard a considerable disturbance in the jungle, and hastening to the spot they found that the tiger had returned to the attack and had succeeded in killing a buffalo calf. Such boldness can only be explained by supposing that it was a tigress and a very hungry one, but if a tiger can kill, as here, from a herd on the alert, it is reasonable to assume that victims can be obtained from herds off their guard.

Solitary buffalo bulls are found with the tame herds in the grass lands to the south of the Reserve, but unfortunately these are the degenerate creatures kept by the Nepalese, and the services of the wild bulls are of no value to the cows. The mother often dies on account of the calf being too big, or the calf itself, if born alive, frequently only survives a few days. It has now been proposed to exclude the Nepalese buffaloes from this piece

of country and to encourage the Assamese to bring in some of their magnificent animals, which are so nearly related to the wild stock that the breed is improved by crossing with the wild bulls : in fact, such crossing is essential if the breed, which is valuable on account of its superior milking and draught qualities, is to be maintained. Wild calves are still occasionally caught and reared by the Assamese, but increasing cultivation is rapidly removing the opportunities of obtaining wild blood in this way. According to Rowland Ward's "Records of Big Game" three species of buffalo are supposed to have been found in Assam : an extinct race, which was characterised by horns very much horizontally inclined and of great span, the ordinary, and a light-coloured species.

The justification for any such classification is obscure, and it looks as if the extinct race had been described from a few isolated specimens, and the light-coloured race from one solitary skin. Wild buffaloes with horizontally inclined horns, are occasionally killed nowadays, and tame buffaloes with horns of this type occur, while light-coloured domestic buffaloes are so common that it must be possible for such to occur occasionally in the wild state.

If it is safe to judge by the appearance of the domesticated stock, the wild buffalo of Burma must be a different animal from the Assam species. In the Brahmaputra valley tame buffaloes are fairly long-legged, while the horns of both the wild and the tame display a distinct backward trend before sweeping forwards to form the tips : in the Surma valley the so-called Manipuri buffaloes, which really come from Burma through Manipur, are short-legged and very tubby, and the horns do not show any backward inclination at all. A selected pair of Manipuri buffaloes were sent to Calcutta for King George's inspection.

The *mithun* is found nearly everywhere in the Sanctuary, but most commonly along the foot of the Bhutan Hills. The Assamese believe that two *jots* of Mithun exist side by side—the large "Moh-Mithun" and the smaller "Goru-Mithun," but I am absolutely convinced that this is only another case of careless observation on the natives' part. I have never found any one, who could point me out a solitary bull of the small species or a

cow of the big species, and the myth has probably risen from the fact that bulls sometimes considerably exceed in size the average specimen. At any rate, a cow to match the big bull should be produced by those who want us to believe in the two *jats*.

Europeans also have a theory that there are two races living side by side. One with a dew-lap and only slight convexity of the skull between the horn bases, and the other deficient in dew-lap but with a pronounced convexity. The former species is described as being *Bos frontalis*, the origin of the Gayal or tame Mithun, and the latter as the genuine *Bos gaurus*. It is noticeable, however, that observers, as opposed to shikaris pure and simple, do not subscribe to this theory, and Stuart Baker, who went into the question very thoroughly, came to the conclusion that the peculiarities of the Gayal, notably the shape of the head and trend of the horns, were only such as might easily occur as the result of domestication. Wild Mithun, it is true, exhibit considerable differences as regards the presence or absence of a small dew-lap, shape of skull and horns, size of body, etc., but I am quite convinced, from the many opportunities I have had of studying the live animal, that all the different varieties can be found in almost any large herd. The truth is that a young wild bull, 2 or 3 years old, bears a strong resemblance in life to a typical Gayal, and the skull and horns are not dissimilar, but the differences become increasingly accentuated the older the bull. It will nearly always be found that the so-called intermediate wild heads are from youngish animals, which often attain to great bulk of body before their heads are, from a sportsman's point of view, really mature.

The Gayal is at its best in the North Cachar Hills, where wild bulls sometimes consort with the village herds, the individuals of which are larger and less docile than is the case with those living in less favoured hills. The Kukis in Manipur obtain fresh blood for their herds by purchasing bulls from the North Cachar Kukis and Nagas. In one Range in North Cachar it is quite interesting to pass through the Cachari villages, with their fine buffaloes at the foot of the hills, and then ascend to the Kuki and Naga villages with their Mithun herds, the stock in both cases

being kept up to standard by infusions of wild blood. In the Himalayan hills, north of the Brahmaputra, the wild Mithun have been exterminated by the hill tribes, and the village Mithun are consequently small and degenerate. In many cases, too, the colour has run, so to speak, and instead of the typical black bodies with white stockings, piebalds are common. The Bhutan Mithun in the country north of the Sanctuary are apparently ordinary cattle with a distant dash of Gayal blood, which comes out chiefly in the black and piebald colour and the short broad head.

The possession of Mithun is considered a sign of wealth amongst the hill people. They are not milked, but are eaten on State occasions, and are useful for purchasing brides and sacrificing at the funerals of Chiefs. The herds remain untended in the jungle during the day and return to the villages for the night of their own accord, being encouraged to do so by occasionally being given a little salt. Bulls sometimes get a trifle bad-tempered, but this is rare; one's principal objection to the Mithun is that they have a very keen nose for a stranger, and come and blow round the tents all night, if camp is pitched near a village. I was once having dinner near a Kuki village when my servant, a new man, caught sight of a Mithun as it emerged from the forest into the moonlight, just as he was going to hand me a dish; he dropped the dish with a howl and streaked for the cook-house fire, having mistaken the beast for a bear.

Hill tribes are sometimes fined so many Mithun by Government, but difficulty is experienced in disposing of the animals in the plains. They are difficult to keep alive unless free to spend their days in the forest, but planters, who have a little jungle on their estates, will take bulls to run with the coolies' cattle, and these may live a few years.

Sambhur, Swamp deer, Hog and Barking deer are all found in the Sanctuary, the Swamp deer being the most plentiful. The Sambhur is the Malayan variety, solitary in habit, with a big body and inferior antlers.

Pygmy Hog are not uncommon, and the *ordinary wild pig* exists, to divert to some extent the tigers' attentions from the more

worthy deer. The country being unridable, pig are a pest all over Assam. Guns are licensed to the villagers for the protection of their crops, but it is observed that the Hindus practically never shoot pig, which they are forbidden to eat, but reserve their powder for the deer. It is a fact, however, that deer do very little damage to the crops; they are not attracted much by ripe grain, but have a weakness for the young shoots when the upland rice first sprouts, swamp deer being the worst offenders. Deer are scared at once by a shout, but pigs, which commit havoc once the grain begins to ripen, become fearless at night unless fired at.

It is difficult to understand how Honorable Members of Council have the face to ask for the repeal of the Arms Act on the plea that the ryots' crops are being ruined, because they must know the facts.

Europeans are commonly deceived, because when they are told that "pohu" are destroying crops, they imagine that the allusion is to deer. By "pohu" a European always means a deer, but the Assamese, on the contrary, may mean anything from a porcupine to a Sambhur; the word needs to be qualified. If the complaining villager is asked what sort of "pohu" are doing the damage, he will say, nine times out of ten, that they are "Gahori pohu" or pig. Up-country men are taken in the same way. There was a great hurroosh one day, when the Brahmaputra was in flood, that a "pohu" had been washed ashore on a small wooded island opposite the town. Some Mahomedans joined in the chase and their boat was the first to reach the island, but when they found that the occupant was an angry pig instead of a mild and edible deer they started to revile the people for having said it was a deer.

Tiger and bear (Himalayan, not the sloth) are common, but leopards do not seem to find the wastes of the Reserve so attractive as the village lands elsewhere. There is no doubt that tigers are very plentiful, and permission would be given to shoot them, but it would be a poor place to come to for tiger-shooting.

Beating is absolutely out of the question on account of the thickness and continuity of the cover, while cattle and buffaloes tied up for kills are regarded more as curiosities than anything else by these well-fed tigers. There is no doubt that tigers kill

occasional rhino calves when the mother is not at hand, and also regard baby elephants as legitimate prey. In the case of the latter the tiger's aim seems to be to rush in and kill a calf, and bolt before it can be caught, as it well knows that the mother will after a time leave the dead body. I have seen an elephant that had a chronic sore back, where it had been mauled by a tiger in its young days, and knew an elephant that was found standing in the forest by her dead calf, so lacerated and weary from a struggle with a tiger, that she was unable to get away and avoid capture.

Hyaenas and *wolves* do not occur in Assam but the ubiquitous *wild dog* is a resident. It is commonly asserted that there is a big race that goes about in small packs of half-a-dozen or so, and a small race that travels in large packs. It is, also, equally commonly said that the game may be blinded by the dogs micturating on bushes, lining the paths along which it is intended to drive the prey.

The proof or disproof of either of these theories would be difficult.

It has been suggested that the large packs appear to be made up of a small *jat* of dog because of the number of half-grown pups running with the packs, and that what are mistaken for a big *jat* are really a few mature animals that have separated from the main pack at the commencement of the breeding season.

The failure on the part of hunted deer to avoid rocks and other obstacles in their path is ascribed by some to the fact that the deer have run themselves to such a condition of numbness that they are incapable of noticing anything, but I once had a young Sambhur brought to me alive by some villagers, who said that the mother had been blinded by wild dogs and that they had caught her too, but she was too powerful for them to hold. There was, of course, no proof that she had been blinded by wild dogs, but the villagers seemed to regard it as the obvious explanation.

The wild dog has not become the pest in Assam that it is in other provinces, and I have noticed that the species most distinctly prefers the hills to the plains. I do not know if this has been observed elsewhere. Packs make periodical swoops down into the

plains, but they certainly seem to spend most of their time in the hills, even if there is less game there.

It was thought at first that a Game Sanctuary, from which European sportsmen would be excluded, would end by being nothing but a preserve for the tiger, wild dog and native poacher. Time has shown that this is not the case. So far as the tigers and wild dog are concerned, there must always be the balance, imposed by nature, between the hunters and the hunted, while the amount of poaching, detected or suspected, is not alarming. Complete immunity cannot be hoped for, and even in England, where comparatively small estates are protected by dogs and numbers of trained keepers, raids occasionally take place.

The Assam Sanctuaries will come into their own in the days, not so distant now, when communications will have improved, but opportunities for observing the habits of big game have decreased. All over the world the rifle is giving place to the camera as the stalker's weapon, and we are now waiting to welcome the photographer to our Sanctuaries.

A NOTE ON PRECAUTIONS WHICH CAN BE TAKEN WHEN TIGER-SHOOTING IN THE CENTRAL PROVINCES.

BY A. A. DUNBAR-BRANDER, I.F.S.

1. The following remarks are not intended for the experienced shikari, who presumably knows what he is about and pursues his game with a tested confidence in his own abilities and a knowledge of the habits of the game he pursues. It is unnecessary, therefore, to discuss the precautions to be taken in which an unwounded tiger is deliberately followed up on foot with the intention of shooting it. Either the shikari possesses the necessary experience or he does not, but in either case his action presupposes a self-confidence that makes any remarks on the subject superfluous.

The recent and lamentable death of Mr. Bell, I.C.S., the result of following up a wounded tiger under circumstances in which the exercise of certain precautions would probably have prevented the accident, makes the present moment an appropriate one for

impressing on all who hunt tigers the necessity of taking every measure which tends to eliminate danger.

2. It will be the experience of all, however, who constantly frequent the jungle, to occasionally come across a tiger. Under these circumstances, any one with the slightest enterprise would have a shot at it, and in most the paramount idea would be to bag it, apart from merely firing.

In most cases the tiger will turn tail or bolt or attempt to slink out of sight : in such cases, there is practically no danger in firing, and a hurried or unaimed shot can be taken without serious risk, and a hurried or unaimed shot is often the only shot possible under the circumstances. There is also little danger in following up the tiger before one has fired : the intention of the tiger is to get away.

3. Occasionally, however, the tiger will assume an attitude which shows that his mentality towards the sportsman is such that he expects the latter to give way to him.

Shooting under these circumstances is attended with risks. Usually, the greatest deliberation can be taken over the shot and no hurried concern, lest the tiger should be off, need disconcert the sportsman's mind : in fact, the more careful and deliberate the aim, the more likely the death of the tiger.

4. An animal when suddenly fired at at close quarters, puts itself in motion and the first rush is often in the direction in which the *body* is pointing at the time : the muscles come into play before reason controls the direction of the motion. It is advisable, therefore, when the tiger is directly facing one, to avoid firing unless one is sure of being able to kill or cripple : this rule applies equally whether the animal is aware of one's presence or not. As soon as the animal turns aside, a shot can be fired with comparatively little risk. The same applies to a tiger which is approaching in a line which will bring him past the sportsman slightly to one side : there is considerable risk in firing while the tiger is still in front. A fair balance between eagerness to shoot and safety is to allow the tiger to approach a point opposite the sportsman : further safety can be ensured by allowing the tiger to pass.

5. The number of persons who shoot tigers off elephants in these Provinces and the number of times, in which dangerous charges take place, are so few under these circumstances that no remarks on the subject are called for.

6. I cannot recollect a case in which a sportsman has been mauled when getting down out of a *machán* at night. Provided one's men can approach the tree, it is usually safe to descend and retreat with them : under circumstances other than these, the sportsman who prefers to return to camp, rather than spend a cold or hungry night in the tree, does so at his own risk.

7. The great majority of accidents occur in following up wounded tigers on foot. It is practically impossible to lay down rules which will meet all cases ; so much depends on the psychology and skill of the individual and the nature of the terrain in which the hunt takes place : nevertheless, the following general principles apply. "The essence of strategy is knowledge and forethought of tactics surprise." In the hunt strategy lies with the shikari and tactics with the tiger. The precautions to be taken are chiefly aimed at the elimination of surprise. A straightforward charge with the shikari warned and prepared for it and which gets home merely indicates that the sportsman is not sufficiently skilled with his weapon for the position he has put himself into and no rules can deal with this ; however, good shots and experienced shikaris can be rushed by the surprise and suddenness of the attack.

8. Some knowledge of the nature of the wound inflicted is the first information to be gathered, as it helps to indicate the likelihood of being attacked and the nature of the attack when it comes. A blind "tucked in" rush forward immediately after the shot usually means a death shot, often in the heart, and the animal drops at the end of his gallop. This must not be confused, however, with a shot through the paw or low down in the leg. In this case, after a bound or two, the tiger often gallops wildly forward and makes a very similar rush as in the case of a heart shot, but the action is not tucked up or short and the rush is not "blind" : by this is meant that obstacles are avoided and a short follow up usually discloses this ; an animal wounded in this way is

usually very dangerous. Large quantities of blood often indicate a superficial wound : in a dangerous wound which has penetrated the body most of the bleeding is internal. Stomach wounds show very little blood. Mere muscle wounds often show considerable blood to commence with, but rapidly dry up. Other indications of where the wound has been inflicted are pieces of bone, intestine, or liver ; froth and blood indicate a lung wound. Blood on each side of the trail shows that the bullet has passed through the animal and the position of the blood on grass indicates the height of the wound. A tiger, whose back has been broken, is practically helpless ; nevertheless, it is a golden rule to look upon any tiger, which shows the slightest signs of life, as a highly dangerous animal and lead should be poured into it until all signs of animation have ceased, and this rule cannot be too strongly impressed on the sportsman, who often has an opportunity of doing so when still in his *machán* but hesitates out of consideration for the skin and which he may risk his life to procure subsequently. It is a fairly common occurrence to see a tiger's tail waving perpendicularly in the air, the tiger being stationary at the time. I have never known this not to be a sure sign of death. A wounded animal may be dangerous to follow up by reason of the wound being so severe as to make it almost certain that he will not try and escape, in spite of the fact that such a wound probably cripples him to some extent in his charge : on the other hand, the wound, if permitting the animal to make strenuous efforts to escape, will be no hindrance to his charge when it comes. The following is probably the "order of danger" with relation to the wound inflicted :—

- (a) A stomach wound : it usually makes the tiger very angry and is no impediment.
- (b) A shot through the paw or a broken leg low down : the nature of the wound makes him disinclined to escape and it has surprisingly little effect on the speed of a short rush.
- (c) A muscle wound : the tiger is often very little affected, and it does not make him nearly so angry as in the case of a stomach wound.

- (d) A shot in the liver : practically no impediment to the charge, but the tiger is drowsy and disinclined to move : given time, he will die.
- (e) A shot which has shattered one of the limbs high up : such a wound is usually a serious impediment to the charge.
- (f) A lung shot : the tiger is very disinclined to move and avoids going up hill.
- (g) A broken back : the tiger is practically helpless.

It is unusual to have wounds (e) and (f) inflicted without their at the same time being deadly, although death may not immediately supervene. It is always a wise precaution, therefore, to wait some time before following up, but here again we are up against the temperament of the hunter, whose actions will be directed by the strongest impulses and increased danger will often be less intolerable than the anxiety and irritability induced by waiting.

9. Most tigers shot in the Central Provinces are killed from *macháns*, either by sitting up, or in beats.

In the former case and supposing the animal to have got away wounded—and we will assume it is getting dusk or even dark—the wisest course is to come away at once and postpone the hunt till next morning. It is very probable the tiger may have died. If the tiger has gone some distance to find water, he is probably not mortally wounded and he is very likely to be found in the vicinity of the water, which should be approached with extreme caution and from above, giving special attention to all dense cover in the vicinity. A good plan is to surround a considerable area round the water with men on trees and gradually contract the ring. The tiger is almost sure to be sighted and can be killed with comparative safety. If the tiger has made no attempt to reach water, he is very severely wounded and is probably dying. He will be very disinclined to move and will not tolerate being shifted far, in fact he will often only shift once. The above remarks only deal with the special conditions arising out of the fact that the tiger has been wounded some 12 hours previous to being followed up.

Most of the precautions enjoined in the succeeding paragraph, however, are equally applicable.

10. We will assume that a tiger has come out in a beat, been wounded and gone through, a very common occurrence in these Provinces.

If men can be trusted and spared, it is a great convenience to have three or four posted in trees as markers well behind the beat, say at intervals of 100 yards. They can generally give one most valuable information: the tiger may have lain down before it reached them, they may have seen it die or lie up, in which case it can often be at once surrounded by men in trees and shot from a tree with safety. If the tiger has not reached the markers, then the area between them and the *machán* can be similarly surrounded. If the tiger has gone past the markers, some information regarding the nature of the wound can generally be given.

11. Assuming that the latter eventuality has taken place, and that a long and strenuous hunt is before the shikari, I propose to indicate the average difficulties that will be encountered and the general precautions to be taken. The hunter must bear in mind that his primary object is to locate his tiger, not merely to come up with it: if the latter alone be his object, it either results in the tiger escaping or being killed with the maximum risk to the hunter. By locating the tiger is meant that it is known to be inside a particular patch of jungle which is so surrounded that it cannot move away without being seen. This stage should be reached, if possible, before any attempt is made to kill it. When hunted, tigers naturally lie up in cover and avoid the open, but cover is a relative term, and consists of *nalas*, jungle, rocks, grass or any combination of these four—in fact, any spot which is more “concealing” than the general average of the surrounding country. Such spots, therefore, should be approached with extreme caution, a position should be taken up which gives the hunter an advantage, *i.e.*, beside a stout tree or on an eminence: the cover should then be stoned before advancing, a stone landed near the tiger will produce a growl or he will slink off or he may charge: in the latter case, the shikari is prepared. In thus following up a tiger, only 3 or 4 men,

whom one can control and more or less trust, should be taken. More than this are a nuisance and a source of danger : a considerable body of men can be brought on quietly some hundreds of yards in the rear, as their co-operation will probably be required later on. The sportsman should not attempt to track himself, he should quarter the ground slightly in advance of the trackers and his duties are to defend and protect all concerned from unnecessary risks. Strict silence should be enjoined so as to give one every chance of hearing the tiger. It may be here as well to mention that such a hunt usually commences with great caution : during the first hour every precaution known to the hunter is taken and every sense is fully exercised—not only exercised but stretched to the utmost limit—until nervous exhaustion supervenes, precautions are reduced and the trail is followed with an indifference that was unthinkable in the first few hundred yards. The hunter is, therefore, warned to guard against this by conscious effort.

12. To return to the hunt, however ; assuming that blood and flattened grass show that the tiger had lain down and has been moved : it is necessary to approach the next cover with extreme caution : most tigers will move once but many will refuse to move more than once ; much depends on the nature of the wound. If the cover towards which the tiger has moved is good and the wounds indicate that he is not likely to have gone far, some men should be called up and the area circled before proceeding. It is impossible to give all the *pros* and *cons* which would decide a hunter to apply this process to a particular patch of jungle, but these are often fairly clearly indicated if it is borne in mind that the object is to locate one's tiger before attempting to kill him.

A tigress is more likely to demonstrate and is more easily moved or turned than a tiger ; a tiger, if he has once demonstrated, is more likely to charge and charge home, than a tigress.

13. Assuming that one has located one's tiger, the men should circle the area in trees and the circle should be gradually contracted on the safest sides. The shikari can then climb a tree on the side the tiger is most likely to move to and men can stone the jungle from the other side. If one does not see the tiger oneself, some one

else does, and, as soon as the tiger lies down, the man who sees him can be joined. This is the safest and simplest method of finishing off a wounded tiger. The most difficult terrain in which to carry out this operation is flat country, with a dead level of cover, but such areas are happily not very common.

14. Great caution should be taken in crossing a nala, the tiger often lies down on the top of the opposite bank which should be well stoned before descending to the bottom. Do not follow the trail along the bottom of the nala, keep along the top and let the men spoor along the bottom behind: the tiger is not likely to be in the bottom of the nala, unless it is a steep narrow straight cut nala, generally of the alluvial type. In this case, one may come on him suddenly round a bend; one should keep, therefore, to the top of the nala on the opposite side to that on which he is likely to be and somewhat ahead of one's men.

15. Hills, especially steep hills, "take it out of" wounded animals. A tiger that is going to die shortly will not go up a steep hill. A wounded animal is very apt to lie down on the face of a hill as it tires him or, if it is a short hill, just on the edge of the top. A tiger is much more likely to charge down hill than up, and when he does so he is much more difficult to stop. Never follow up a blood spoor up a steep hill or ravine side. Put some men in trees at the bottom as markers, go round and come down from above stoning your ground in front of you. One can often shoot the tiger with comparative safety from above or he can be driven into the bottom of the ravine and located, and if he charges he is fairly easy to stop and the sportsman is steady by reason of the confidence his superior position gives him.

16. Few tigers will seize a man in their stride; if the man stands still, they pull up dead at his feet and then proceed to bite and claw; in a charge, therefore, stand still, there is nothing so fatal as to move and it often results in a fall. Reserve one's shots, especially the second barrel, until the last moment.

17. Buffaloes are sometimes used in hunting wounded tigers. It is a process, however, which is attended with considerable risks to all concerned. The tiger is apt to work round the ends of

the herd and seize the herdsmen who operate on the flanks and the animals get so excited they are quite likely to charge the shikari. Their use is, therefore, only advocated in certain circumstances. Assuming that one has located one's tiger, but, by reason of lack of trees or the density of the cover (such as is often found in frost hollows full of tall grass), it is found impossible to shift or sight him and to enter the cover would be practically to commit suicide. buffaloes or even cattle can be employed with effect. They should be rushed into the cover without giving them much time for deliberation; in fact, this is the only method possible with cattle. The tiger may shift and may be shot while doing so, or he will spring on the back of an animal, when the sportsman has to run in and shoot him. Where the necessity of employing this method arises, the sportsman is warned that he is undertaking a highly dangerous performance.

18. A concluding word may be said on weapons. These should consist of the heaviest double-barrelled rifle the sportsman can conveniently handle, and, if a tiger has been wounded with a small bore, the arrival of a heavy weapon should be awaited before any attempt at following up is made.

Summary of rules and precautions to be taken so as to reduce risks in tiger-shooting.

1. Avoid firing at a tiger whose body is directed towards you, unless you are sure of your aim: as a precaution, allow him to turn to one side.
Shooting on foot.
2. If the tiger is coming towards you, unless sure of your aim, allow him to get to one side, or even past, before firing.
3. At night, if the demonstrations of a tiger prevent one's men coming to the foot of the tree, the sportsman who descends and returns to camp does so at his own risk.
Sitting up over a kill.
4. A tiger which has been wounded overnight and has gone any distance to water will probably not die and is probably near the water.
5. A tiger which has been wounded overnight and has made no attempt to reach water, is probably mortally wounded. He will not tolerate being shifted much.

General. 6. Most accidents occur through surprise attacks.

7. In following up a wounded tiger, let the shikari have as his object the locating and surrounding of the tiger before attempting to kill it.

8. Do not follow blindly along the trail with the chance of stumbling on to it : the tiger will move away until he makes up his mind to make his own attack at his own moment.

9. Wounded tigers lie up in cover which consists of nalas, jungle, rock, grass, or any combinations of these four : in fact, any spot which is more concealing than the general average of the surrounding country.

10. Approach all cover with caution and stone it before entering it, taking up a position of advantage beforehand.

11. A wounded tiger cannot be moved indefinitely from cover to cover : sooner or later, he will turn.

12. A tigress will shift more often and more easily than a tiger and is less inclined to charge home.

13. All tigers charge down hill much more readily than up and are much more difficult to stop when doing so.

14. Look upon all tigers, which show the slightest signs of animation, as dangerous animals and continue firing until all such signs have ceased.

15. All wounded tigers are dangerous ; more so, according as the wound is situated in the stomach, low down in a limb, a flesh wound, the liver ; less so, high up in a limb, the lungs, the back.

16. In following up a wounded tiger study all indications, which show the nature of the wound.

17. Do not attempt to gather a wounded tiger at night or at dusk : wait till next day.

18. If charged, stand still and reserve fire to the last moment, especially the second barrel.

Beats. 19. When a tiger comes out, remember general rule 14 and thus, if possible, avoid a dangerous follow up.

20. If trustworthy men can be spared, have 3 or 4 men in trees, at intervals of 100 yards behind, to act as markers.

21. If there is time to do so and your temperament permits, delay some time before following up.

22. Select 3 or 4 of the best men only to accompany you.

Following up wounded tiger after the beat. Others can follow at a distance behind. Insist on silence.

23. Do not attempt to track yourself, look out for the tiger instead.

24. Remember the general rules, especially 7, 8, 9, 10, 11, 12, 15, 16 and 18, as they will almost all be applicable.

25. If the tiger growls or shows up in any way, put a man up a tree, he can often see it and can be joined.

26. If the tiger has been located or there is a strong probability that he is in a particular cover, surround it with men in trees, get into a tree covering the most likely break and have it stoned out from the safest side. Men can advance, with comparative safety, from tree to tree, after stoning, provided some remain up as markers.

27. Stone the opposite side of a nala before crossing.

28. Do not follow a trail down the bottom of a nala, stick to the edge of the bank opposite the tiger and in advance of the trackers.

29. Never follow a wounded tiger up a steep hill or ravine side. Put men in trees at the bottom, go round and come down from above. (See general rule 13.)

30. Be particularly on your guard against relaxing precautions after the hunt has proceeded some time and exhaustion has set in.

31. Use buffaloes or cattle to drive out a tiger located in otherwise impossible cover.

RAISING SEEDLINGS OF TIMBER TREES IN GREAT BRITAIN.

The following note addressed recently by Lord Barnard to the members of the Surveyors Institution may be of interest :—

Lord Selborne states :—" The increasingly heavy demands " which the war is making on our timber will necessitate a great " amount of planting later on. Nurserymen are suffering severely " from the shortage of labour, and it is likely that after the war " their stocks of plants will be smaller than usual. The seedlings " may easily be raised ; and I hope that a number of members of " your Society will take the matter up.

" I enclose a list of the species which we think are likely to be " in most demand after the war.

" It would, I think, be well to impress on members of the " Society the usefulness of even small sowings, for in the aggregate " a large number of seedlings might result."

The list referred to is as follows :—

Larch	Sitka Spruce	Douglas Fir	Corsican Pine
Common Spruce	Scots Pine	Silver Fir	Beech.

EMPLOYMENT OF CANADIANS ON FOREST WORK IN GREAT BRITAIN.

"Several hundred men have already joined the ranks of the Forestry Battalion of 1,500 men, now being organised in Canada at the request of the War Office for special work in Europe. It is expected that the full complement will be ready shortly, after a brief training at Petawawa, to proceed to England."

A correspondent forwards the above cutting from the *Times*' Weekly Edition of April 28th, 1916, and suggests that the activities of the Canadians referred to would probably not be confined to fighting but they might be also engaged on State Forestry in Great Britain.

The correctness of this supposition is confirmed by the following extract from *American Forestry* for April 1916:—

“Timber is becoming so scarce in England and high freights and scarcity of ships have rendered the situation so acute that the War Office has asked the Canadian Government to enlist a battalion of woodsmen to cut timber in England. Recruiting will start at once. Lieutenant-Colonel Alex. McDougall of Ottawa will be in command.”

CORRESPONDENCE.

TO THE HONORARY EDITOR, *Indian Forester*.

A POSSIBLE CAUSE OF “SPIKE” IN SANDAL.

SIR,—The article under the above heading in the May number of the *Indian Forester* by Mr. Whitehead says that “Sandal is a parasite, but it is dependent upon the foster-plants only for its supplies of water and salts.” If the obligatory parasitism of Sandal-wood plants is conclusively established, Mr. Whitehead’s “possible cause” is a very good working hypothesis. From my short note in last January number under the heading “Sandal-wood—its parasitic habit” and from my subsequent observations, I am still led to doubt if Sandal-wood cannot get on without parasitism. I have three very healthy plants growing at the present moment with no foster-plant within a radius of 30 feet. Even the grass grown around the base of the plants is thoroughly weeded out. The three plants will be two years old on July 17th. If Sandal is established to be a parasite and if it, as Mr. Whitehead suggests, “depends upon the foster-plants only for its supplies of water and salts” whence do my three plants get their water and salts? It must be from the soil as there is nothing else to get them from. I wish I could say *Nil desperandum!*

TRICHUR: }
13th June 1916. }

K. GOVINDA MENON,
Conservator of Forests, Cochin State.

EXTRACTS.

AFFORESTATION IN SCOTLAND.

DEVELOPMENT URGED UPON GOVERNMENT.

The Royal Scottish Arboricultural Society have sent the following statement and resolution on the subject of the development of afforestation in Scotland, to His Majesty's Ministers and all the Scottish members of Parliament:—

The Council considering:—

1. That for many years the Society has been urging upon Government the necessity for adopting measures to promote afforestation in this country;
2. That all our home experts in Forestry, and such of the oversea experts as have visited this country, including the eight distinguished foresters who represented the leading Continental, Indian, and Dominion forest services at the Society's diamond jubilee celebrations in 1914, have unanimously expressed the opinion that Scotland lends itself admirably to afforestation on a large scale, and that Government ought to give the movement the support necessary to bring this about;
3. That in recent years successive secretaries for Scotland have promised on behalf of Government that a Department of Forestry would be created in connection with the Board of Agriculture for Scotland, but that such Department has not yet been formed;
4. That the Board of Agriculture for Scotland and the Development Commissioners have failed to make reasonable provision out of the funds under their control for the development of forestry in Scotland, and that it is therefore necessary that the new Department of Forestry, when formed, should be provided with a separate annual grant adequate for this purpose;
5. That the area of woodlands in Scotland previous to the war was about 868,000 acres, or only about 4 per cent. of the whole land area, being the lowest percentage of the countries of Europe

(except Ireland and Portugal), and forming a striking contrast to other countries on the Continent having from 17 up to as high as 53 per cent. of woodlands ;

6. That the annual value of the imports of timber into the British Isles previous to the war was about £40,000,000 ; that between 80 and 90 per cent. of the timber so imported consisted of coniferous or soft woods of which a large proportion could have been grown in this country, and if so grown would have provided healthy and remunerative occupation for a large rural population, and have prevented the present timber famine and the great shortage of tonnage from which the country is now suffering ;

7. That the war in which the country is at present engaged has directed particular attention to—

- (1) the dependence of this country on foreign countries for timber of all kinds, but especially pitwood and railway timber,
- (2) the greatly increased demand for all kinds of home-grown timber, which, owing to the widespread devastation on the Continent, is likely to continue long after the conclusion of the war,
- (3) the large areas of home woods that are being cleared to meet that demand, including young, thriving plantations, prematurely cut for pitwood, for which they were not intended,
- (4) the improbability that all, or even a large proportion, of these areas will be voluntarily replanted, with the result that the already relatively small extent of woods in this country will be alarmingly decreased,
- (5) the very large areas of comparatively poor land in the country which would be more economically used in growing timber crops than as at present used ;

8. That during their various excursions abroad the members of the Society were much impressed with what had been successfully done by the various Continental countries visited in combining schemes of small holdings with afforestation, to the great advantage of both ;

9. That afforestation not only provides employment for a considerable population at the outset, but ultimately for a very large population in connection with subsidiary industries such as saw-milling, wood-working, and other rural industries ;

10. That at the close of the war a large number of men will be returning home who may not be able to resume their former occupations, and would prefer to settle upon the land if they could be assured of a healthy outdoor life and a comfortable home and that the return of such men will form a peculiarly suitable opportunity for making a beginning with the afforestation schemes which are so necessary to provide timber for our national requirements.

Resolved—That it is necessary, in order to provide for the nation's future requirements of coniferous timber and such hardwood timber as can be economically grown in this country, and also to afford suitable and healthy employment for a large and ever-increasing rural population, that Government should now create the promised Department of Forestry in connection with the Board of Agriculture for the development of forestry in Scotland, with an adequate annual grant for the purpose, and should instruct the Department to prepare, without delay, schemes of afforestation, combined with small holdings and other rural industries, to be put into operation as soon as the war is over, so that advantage may be taken of the unique opportunity when returning soldiers, sailors, and others are desiring work, to induce a proportion of them to settle on the land by offering them immediate and suitable employment in comfortable and congenial surroundings.—
[*Timber Trades Journal*.]

FORESTRY IN AUSTRALIA.

The recent conference of Federal and State representatives in Melbourne unanimously carried a resolution approving the establishment of a central school of forestry by the Commonwealth and the States, and also that a special training school of tropical forestry should be instituted. The subject of forestry is one that is attracting increasing attention throughout Australia, and all the States are

giving it serious attention, though so far small practical results have been achieved. The Minister for Lands of New South Wales has announced his intention of submitting to his Cabinet definite forestry proposals, and he states that very shortly three million acres of State forests will be allocated. It will be the duty of the Forestry Department to conserve the timber interests of the States, upon approved lines, ensuring the cutting down of only matured timber and planting fresh forests.—[*Timber Trades Journal.*]

THE LIGHTEST WOOD.

Balsa (*Ochroma lagopus*) is a tropical American tree having a very soft wood that the Missouri Botanical Garden has shown is only about half as heavy as cork.

This wood is being used in life-rafts, life-belts, and for buoys of various kinds, and is claimed to be preferable to cork in other respects as well as in lightness.—[*Capital.*]

BIRD'S-EYE MAPLE.

The cause of bird's-eye figure so familiar in maple wood has been a source of much speculation.....*American Forestry* shows that the phenomenon is produced by adventitious buds, which have their origin under the bark, and may begin to develop when the tree is quite small. These buds, though they may live many years or die and be replaced by others, are rarely able to force their way through the bark to become branches. The Japanese are said to produce artificial bird's-eye growth by inserting buds beneath the bark, a sample of the artificially produced bird's-eye wood being in the Field Museum, Chicago.—[*Capital.*]

INDIAN FORESTER

OCTOBER, 1916.

NOTES ON THE PROSPECT OF WORKING THE HARD- WOOD FORESTS OF BURMA.

The following article, contributed by Mr. H. R. MacMillan, Chief Forester in British Columbia, will be read with interest by Indian Forest Officers and more especially by those in Burma:—

A visitor, particularly from a temperate climate, should be cautious in expressing an opinion on forestry in India. The difficulties under which the work is carried on are obviously beyond his imagination. Therefore, though the writer's conviction that India is a full half century or more ahead of North American forest administration, is expressed on a mid-March noon in camp in a Burma jungle, it does not follow that he feels himself capable of properly appreciating the fight won against climate, exile, subordinate inertia and apathy before results began to appear.

The Forest Service in India is fortunate in having courageously secured complete control of the forest resources of the country. This advantage may not be fully realised by those foresters who

have not seen what has happened in the United States and Canada, where unregulated exploitation has destroyed rich virgin forests, with small return to the Government and small profit to the timber-cutters, and has left, in the place of the forest, land unfit for agriculture, upon which the regeneration of a useful or valuable forest will be a slow and expensive process—so expensive in the case of large areas in Eastern Canada that there is no prospect of its probable accomplishment. Only limited proportions of the forest land, either in the United States or in Canada, are under the management of the Forest Services. North American foresters must yet struggle for generations towards the position already held by the Indian Forest Service, *viz.*, the control of all the forest land in the country and the freedom to manage it for the benefit of the State unaffected by little else than yield, market and silvicultural considerations. It is marvellous that in a land so old as India, the Forest Service should, unhampered by private opposition, administer practically all the forests, and that in a country so new as America, private owners should, unhampered by Forest Services, destroy so much of the forest. It speaks volumes both for the skill and vision with which the early Indian foresters assumed control of the situation and for the destructive tendencies of the Anglo-Saxon immigrants to the new world.

Forestry in India has succeeded in hiding its light under a bushel. The propaganda, which it is necessary to carry on in North America to secure public support and appropriations for forest work, results in all work being widely advertised, sometimes to such an extent that the actual accomplishments when viewed are disappointing. It is refreshing to find that in India the reverse is true, that forest administration is in advance of the accounts that have been allowed to penetrate to other countries.

It is surprising to find that so little cutting is done in reserved forests in India except according to Working Plans which provide for the maintenance of the annual yield. Canada has yet to initiate her first Working Plan, though there are many places, east of the Rocky Mountains, where over-cutting is the rule and

where conditions of market and accessibility make Working Plans already desirable. The situation in the United States is not greatly different. East of the Rocky Mountains practically the whole of the valuable hardwood and pine forests are being wiped out by uncontrolled cutting. Both forest and land have passed beyond the control of Government. West of the Rocky Mountains where the greater part of the United States forest reserves are situated, over two-thirds of the forests have passed into private ownership and are being cut as they become accessible, without regard for any consideration excepting present profit. The forest reservations do not contain the richest nor most accessible bodies of timbers, excepting in a few instances, and there has not yet been such a tendency to over-cut as would be the case with valuable species in Indian forests were no control imposed. Though it has not yet been found practicable nor advisable, for a variety of reasons, to undertake the preparation of Working Plans on a large scale, the United States Forest Service in administering the western forest reservations is keeping the annual cut from each reservation below the possibility of maintained production and is seeking, chiefly by adapting cutting methods to the silvicultural demands of the valuable species, to secure natural regeneration. A great difficulty in the way of forest administration both in Western Canada and in the Western United States is the unprofitable nature of the timber industry, a condition which seems likely to continue, through the ruinous competition induced by over-production of timber and is likely to render any forest regulations, however slight the extra expense they entail, difficult of introduction.

The profits possible and evidently common to the teak industry in Burma are astounding, and incredible to one acquainted with the timber industry in North America. A country where private companies can clear a net profit of 35 rupees a ton on so simple an operation as moving logs one hundred or two hundred miles from a Government surveyed and counted forest to an assured market would seem an earthly paradise to the loggers and timber dealers of Western Canada, where firms build costly railroads into

country which they have explored at their own care and charge, risk their logs two hundred miles in the open ocean, erect their own mills, drying kilns, extensive lumber yards for the manufacture of eight or ten species of timbers into the forty or fifty dimensions and grades in which they must be stocked and put on the market, and in the end, after granting six months to two years' credit on the sales, reap a net profit of two to three rupees a ton.

The situation viewed from the Government standpoint is quite as astounding. One might almost say, so valuable is teak, that the management of this timber resembles a mining operation almost as much as a forestry operation. The profits accruing to the Government on a tree which nets 30 rupees a ton in royalty, or 70 rupees a ton in profit on departmental working, are so great, that even should there only be one or two trees per acre the forester, led like the placer miner of early British Columbia, by the beacon of easy gold, is tempted to manage his forest for teak alone, or nearly so, although the remaining nine-tenths of the forest may consist of useful and probably valuable species of large size, free from log defects and comparatively easy of access. That teak alone should float, that coincident with teak should be that rare, cheap and self-propelling skidder, the elephant, has, together with the great profit possible on teak, made the apparent neglect of the other species natural.

A forester, somewhat familiar with the world's timber markets, and likewise with the quality, condition and cost of production of hardwood timbers, in the regions from which the chief hardwood supplies of the world are now being drawn, may perhaps be pardoned, for venturing to suggest that possibly the time has come when the undeniably rich hardwood forests of Burma might be worked, to the advantage of silviculture, at greater profit than is afforded by the present extraction of teak alone.

A reference to the history of the hardwood forests of North America reveals the fact that originally those forests were considered in somewhat the same light as the hardwood forests of Burma to-day. Two generations ago the southern portions of

Eastern Canada were covered with a dense forest of mixed hardwoods, amongst which and beyond which lay stands of the valuable white pine (*Pinus strobus*). White pine was floatable, was in great demand and the cutting of it for export to Europe was the staple industry of the community. The hardwood forest, containing on an average perhaps twenty-five to thirty tons of timber to the acre, consisting of a mixture varying from about eight to over thirty species, practically none of which would float, was considered a menace to the development of the community. One or two hardwood species, white oak (*Quercus alba*) suitable for the navy of the day and for tight cooperage, and black walnut (*Juglans nigra*), valuable for cabinet work, were extracted. The remainder, other oaks, elms, maples, beech, birch, ash, hickory were by dint of great exertion cut down, turned into potash for export or burned without salvage. Only when destruction was almost complete, thirty years ago, was it discovered that not one of those woods was without its value in the implement, vehicle, furniture, house trimming, general manufacturing and pulp industries that had sprung up in the country. Within a few years after completing the destruction of her hardwood forests, Canada was importing, for her industrial needs, mixed hardwood timber at the rate of over £4000,000 per year. The Canadian hardwoods were destroyed because white pine being a floatable wood was more easily and more profitably extracted and marketed, while the hardwoods being mixed and accessible only by railroad appeared to involve a greater risk and greater effort—an effort that was not forthcoming while white pine was available.

It was proved beyond a doubt, however, when a start was made with the extraction of the mixed hardwoods, that a use and market could be found for all species at a certain profit. The difficulty very quickly became one of forest exhaustion. The parallel between the situation now existing in Burma and the condition two generations ago in Canada is striking.

The objections urged against the extraction of the hardwoods of Burma are, roughly—

- (1) the woods will not float and are therefore inaccessible ;

- (2) the species are low in quality and unmarketable;
- (3) the forest is so mixed that the bringing together of saleable quantities of uniform timber is hopeless.

There may be many areas in (the great hardwood region of) Burma that are inaccessible because the timber will not float, but there are large areas (such as those visited by the writer in the Tharrawaddy Division) where the mixed hardwood forest is incomparably more accessible to the ocean than the greater part of the hardwood forests in America, from which a great portion of the world's supplies are now being drawn. Accessibility of a hardwood forest depends upon the area of the tract, the quantity of timber that may be cut from an acre, the topography and the distance of the tract from an existing railroad or port. The area must be large enough to produce, under the conditions under which it is to be cut, timber sufficient to supply a railroad and saw-mill for fifteen to twenty years. There must be sufficient timber cut per square mile or per acre under the regulations imposed, to permit of the concentration of the extracting operations to such an extent that it will not be necessary to drag the logs too far to the railroad nor to build an excessive mileage of railroad branch lines. The topography of the country, while not necessarily level, should admit of the reaching of the whole area by cheaply constructed light railroad branches about four miles apart. The various factors named are, of course, interdependent, a saving on one charge makes possible a greater expenditure on another, and the combined charges, when compared with the cost of building the railroad necessary to connect the tract with existing communications, and the value of the timber at the point of sale, determine the feasibility of railroad logging.

While it is not possible to attach concrete values to the factors to be considered, it may be stated without hesitation that at least one tract visited in Tharrawaddy meets the requirements in every particular. This tract of about sixty square miles, if cut under the system now being tried for the introduction of the Uniform method, should produce at least fifteen to twenty tons of marketable timber per acre from the present stand. Hardwood forests averaging

about this stand per acre, and no more accessibly situated are profitably extracted by railroad in America. The cost of making the logs and hauling them to the railroad on this particular tract in Tharrawaddy would come to about four rupees per ton for an average haul of two miles. This is on the average cheaper than would be the case for an American logging operation. The construction of the logging railroad to the main line railroad, about fifteen miles, and the construction of the branch lines probably at the rate of one to three miles per year, would involve no difficulties and no expensive work. The ground traversed appears much more adapted to cheap railroad construction, an inexpensive operation, than is usually the case in hardwood tracts now being logged in America. It should be kept constantly in mind that no gauge less than a metre should be used for such timbers as the heavy hardwoods, that the loads will all travel one way, from the hills to the plain and that, therefore, down grade curves to 4 per cent. are permissible, that the standard of construction should be kept as low as is consistent with economical operation in order to avoid piling up overhead charges. The capital cost of the line should be kept low even if a slight increase in the operating charges is involved. This is important for the reason that if the tract is worked over in twenty years, not to be touched again until the end of another rotation, the capital cost of the railroad should be entirely wiped off during the period of working.

Though an accurate estimate of the quantity of timber on the tract is not available and an estimate of the cost of construction of the railroad has not been made, judging from results obtained under similar or less favourable conditions in America, it is safe to hazard the estimate that hardwood timber from the Tharrawaddy Division may be delivered over a railroad twenty miles long, to Letpadan, for ten rupees per ton exclusive of royalty. Under such conditions the hardwood forests can no longer be held to be inaccessible. Were these forests, just as they stand, situated in North America, keen competition would arise for their purchase, they would be logged by railroad, and a portion of their outturn would be sold in Europe, Africa and India.

The prevailing belief that mixed Burma hardwoods cannot be sold appears to be due to several causes, the most important of which are :—

- (1) most of the woods, if used in Burma, are destroyed by white-ants ;
- (2) competition in foreign markets with established American hardwoods ;
- (3) the conservatism of timber dealers ;
- (4) seasoning difficulties have not been solved ;
- (5) the timber has not been put on the market in sufficient quantity ;
- (6) the possible selling price is unknown.

If some of the most valued American woods had made their debut in Burma, they would have been quickly destroyed by white-ants and would have earned an unsavoury reputation which would have delayed their introduction to foreign markets. Possibly Burmese woods, which are lightly valued in Burma, both because they suffer in comparison with the extraordinarily valuable teak, and because they do not resist white-ants, would, nevertheless, meet some of the many varied requirements of foreign markets. The hardwoods in the Burma forests will produce, on the average, longer, cleaner, sounder logs than the present American hardwood forest, and will evidently furnish woods of almost any desired hardness, colour, weight, durability, strength or quality. The chief foreign markets of the world are now dominated by supplies from the United States. American oaks, maple, birch, poplar, elm, beech, gum are exported to Europe, Canada, Africa, Australia and even to India, in large quantities. The demands of the domestic market in the United States are very great and are rapidly growing, the area of hardwood forest remaining is small, the quality of the timber remaining shows deterioration, the price is increasing and the supply available is expected to last, at present rates of consumption, only a decade or two.

The United States cannot continue to export, in large quantities, the species now well known in Europe, nor are there other species that can be substituted from that Continent. The time

appears opportune, when trade becomes normal, to put new hardwood species on the foreign market.

A difficulty to be overcome is the conservatism of the timber trade. Timber is bought and sold in importing countries on name alone. Neither the wholesaler, the retailer nor the ultimate consumer have any means of testing timbers except by trial. Once they discover that timber with a certain name is suitable for a fixed purpose, they demand that timber and depend upon it so long as it is available at a reasonable price. This is particularly the case with hardwoods used chiefly as raw materials by manufacturers. Every new hardwood has, therefore, had a stiff fight. It has only entered the market when the timber originally in demand became too expensive. The marketing of American hardwoods abroad during the past three decades exemplifies this condition. Almost every timber-using trade in Great Britain, though built up by the use of certain American hardwood species, has seen the species originally used become expensive and suffer substitution or dilution by timbers previously considered unfit. While white oak abounded other oaks were considered unsuitable for industrial purposes. The latter now constitute the bulk of the exports. The tight cooperage industry was built up on *Quercus alba*; it is now supplied chiefly by other species. The slack cooperage industry depended originally on basswood (*Tilia Americana*). This species became valuable and so species previously left to rot in the forest, gums, beech, poplar, now constitute the raw material of this important industry. So it goes throughout the hundreds of trades and industrial establishments using hardwoods, all have within a generation been forced, against their will, to accept new timbers, sometimes new species of the same genera, sometimes woods different in family as well as name, yet upon investigation proving, while different possibly in appearance, to possess the characteristics demanded by the industry. Maple and oak have been substituted for hickory for use in handles. Gums under the names of Satin walnut and Circassian walnut have been substituted for genuine walnut in the furniture and cabinet trades; gum, under the name of hazel pine, has been substituted for more valuable hardwoods in manufacturing office fittings. Thr

Japanese, in endeavouring to build up an export trade in hardwoods to the west coast of North and South America, and India, are giving their timbers trade names such as Hakaido pine, Japanese ash, Japanese oak, to indicate the uses to which they may be put, though they may be quite different from the woods after which they are named and with which they compete; this is a wise precaution in order to secure for the wood an easy introduction to the market. After the wood has been supplied to the proper industries at a competitive price, it will be purchased on its own merits. The fact that various families, genera and species have followed one another in maintaining the hardwoods required by the industrial world shows that Burmese hardwoods need not be ruled out merely because they differ in name and minor characteristics from the species now in use. Vehicles, furniture, small woodenware, implements, cooperage, packing cases, machinery and other industries will continue to demand woods of almost every combination of hardness, toughness, durability, strength, cleavability and finish. No one of the four or five score widely varying species from the forests of North America has been found unmarketable. An industrial use and profitable demand has been discovered for all. The same will undoubtedly prove the case for Burmese woods.

Hardwoods vary greatly in their seasoning characteristics. Those which warp or split when seasoned naturally in the open or which develop moulds will require special treatment. This is especially likely in Burma, where the climate will induce too rapid drying and at certain seasons a very rapid growth of fungi. It may be expected that experimenting with gradual seasoning by steam in dry kilns will prevent warping or splitting with most species, and that dipping in inexpensive aseptic solutions will prevent the development of stains in others. Such problems have been so successfully solved with troublesome hardwoods elsewhere as to lead one to expect favourable results when they are taken up in Burma.

Even when other hardwoods were selling at good prices in the United States fifteen years ago, red gum was left standing where

mixed forests were cut, solely because it could not be seasoned by the open-air methods then in use for other species. The seasoning of this timber was investigated by the Forest Service, a simple and inexpensive system was devised, which prevented warping or splitting. As a result, the wood is now in great demand for furniture, cabinet work, cooperage and industrial purposes. Excellent results may be expected from studies of the methods to be adopted in seasoning the hardwoods of Burma. These hardwoods, if once sufficiently seasoned for shipment, will not exhibit the same tendency in temperate climates to check, split or warp as if used in Burma. The problem of seasoning the product from a mixed hardwood forest is of course greatly simplified if sufficient quantities of each of the various classes of species are brought to a common centre each year to make economical handling possible. This would be the case where railroad logging operations were in progress.

A vital point in marketing new or unknown timbers is the maintenance of a constant supply on the market. There is nothing gained by sending a new product to market in wheelbarrow loads. A new species may be eminently suitable for vehicle manufacture; a few logs are sent to a manufacturer in England for trial; the wood is found satisfactory; the manufacturer or timber importer enquires the price at which several hundred tons a year can be delivered at an English port; an answer is not forthcoming and the business drops and yet the difficulty may not have been in the quantity of the particular timber available in the forest. Several species likely to be valuable are more plentiful in the forests of Burma than any hardwood species in the United States. Several useful species now standing unused are probably quite as plentiful as teak. The difficulty lies in the fact that these species are not now being taken out in commercial quantities. If one or two thousand acres of hardwood forests were cut over in one felling series each year, a sufficient quantity of the various timbers suitable for the various trades would be accumulated each year to interest the importers and to develop an export demand.

Once a supply of a few thousand tons of each of the various classes of timber, suitable for such industries as vehicle building, machinery, implement, handle, furniture or cabinet-making, is assured each year, it should prove easily possible to make sales. It is manifestly impossible, however, to develop a market either when only a few logs of a species can be secured at odd times, as at present, or where one species alone must bear the whole cost of making the roads, and improvements for extraction, as is now the case with pyinkado.

Burmese hardwood timber can be placed upon the different foreign markets, if extracted and manufactured in the same manner as in the United States, at lower prices than were demanded for American hardwoods before the war. There is not sufficient space here to enter into detailed comparisons of cost, but it is safe to estimate that converted Burmese hardwoods can be placed on the British market, in times of normal freights, including an average royalty to the Government of seven rupees a ton, for seventy-five rupees a ton. The freedom of Burmese hardwoods from knots, decay and defects will make possible the production of a very high grade of timber such as cannot now be secured in American species on the English market for less than eighty to one hundred rupees per ton.

The organisation which will make it possible to sell Burmese hardwood timbers at competitive prices on foreign markets will also make it possible to get over the difficulty, hitherto insurmountable, of assembling at one shipping point a sufficient quantity of each of the various classes of timber to make it possible to work up a market for the complete produce of a tract. If one or two thousand acres of mixed hardwood forests were worked over annually, about twelve to fifteen varieties of timber would be produced or about the same number or even less than are produced on a similar area in the United States. The various species when converted would be kept separate, except in cases of species so alike in quality as to be suited for the same purpose. Such species might well be marketed under one name. Several hundred or several thousand tons of each species would be

accumulated in stock. There would be the assurance of like quantities through succeeding years, and the difficulty of mixed species, no worse on any one large tract in Burma than in the United States, where thirty species are sometimes found together, would be solved.

There are several important reasons why the opening up of the mixed forests of Burma by railroad should be considered :—

1. The hardwood forests of America are becoming exhausted.
2. Other countries, no more favoured than Burma, are now entering the export field.
3. A large market exists in Europe, India and Africa.
4. The revenue of the province would be greatly increased.
5. The means would be provided of more profitably introducing the Uniform system.
6. The development of local industries would be encouraged.
7. Mechanical skidding machinery would be rendered possible.
8. Resultant concentration of operations would facilitate control by Forest Officers.

The industrial countries of the world are yearly importing increasingly larger quantities of hardwoods. The home demands of the United States and Canada and the steady export drain have already put several important species practically beyond reach and have reduced others to the point where export supplies are available for only a few years longer. Already a trickle of trade, destined to increase, has set in the other way, and tropical hardwoods, for house-finishing, electrical industries, railway coach-building, cabinet work and furniture-making are being imported into both the United States and Canada. It will soon become necessary to find a new source of supply. As American supplies become scarce, prices will increase, giving Burmese woods an even more favourable opportunity to compete. As American hardwoods become exhausted, the trade names under which they have been sold, hickory, ash, oak, chestnut, elm, walnut, cherry, will gradually lose a leading position on the market and the competition of woods with hitherto unfamiliar names will be facilitated.

Whether the future export trade in hardwoods is carried on from Burma, Japan, the Philippines, Borneo or Siam, will depend very much on the initiative shown in developing Burma forests.

As compared with the countries named, Burma not only possesses the largest forest areas to be found in the countries named but also possesses the areas most advantageously situated with regard to the export market. Shipments made to India alone in recent years from the above countries show that the development of mixed hardwood forests is already an important factor in the trade of countries possessing no natural advantages over Burma.

Imports of manufactured and unmanufactured hardwoods into India in 1913-14 from countries recently undertaking production of hardwoods :—

Countries of origin.	Value.
	£
Japan	277,764
Straits	99,767
Java	10,629
Philippines	3,030
Total ...	391,190

No statement of imports is necessary to show the great demand in Europe and elsewhere for hardwood timber suitable for manufacturing and industrial purposes. The industrial nations of Europe have long since ceased to meet their own requirements and have become yearly increasingly dependent on America, a source which already shows signs of failing.

The home market in India is very important. The annual imports of hardwoods, which might well be supplied from the accessible Burma forests, are :—

	Value imported in 1913-14.
	£
Tea chests	349,435
Sleepers	255,153
Manufactured articles	64,282
Total ...	668,870

The tea chests are nearly all made from hardwoods, chiefly alder and birch. A large proportion of the sleepers and almost all the manufactured articles are similarly made from hardwoods. Furthermore the commodities listed above do not require such qualities of timber as would be difficult to secure in the forests of Burma.

It is simply a question of getting the timber out in somewhat the same manner as it is taken out in other countries. Forests more difficult to reach from the sea than some of the forests in Burma, and no richer, are being developed ten to twenty thousand miles away and the manufactured timber exported to India in large quantities.

The sleeper trade of India alone offers great possibilities. One of the obstacles now in the way of its development is the fact that local timbers are not cut on a sufficiently large scale, either to provide commercial sized shipments of the durable timbers, or to make it worth while to give preservative treatment, as is done in other countries, to the sufficiently hard, but non-durable, timbers.

South Africa is under the necessity of importing all her timber requirements. The large quantities of hardwoods now imported come chiefly from America and Australia. Neither of these supplies will continue indefinitely; Burma is well situated to take up the trade.

No volume of export trade in hardwoods appears to be too large for Burma to contemplate. The mixed hardwood forests of Burma cover as large or larger areas than the original total hardwood forest areas of the United States, they are more accessible, and they have the added advantage of coming into development at a period when the demands for hardwood are greater and more varied, the prices higher and the facilities for extraction and manufacture much more highly developed than was the case when North American forests were developed.

Lacking a valuation survey, it has been estimated that the mixed hardwood forests of Tharrawaddy would produce fifteen tons per acre exclusive of teak and that the royalty would average

seven rupees per ton. A revenue from royalty of at least one hundred rupees per acre exclusive of teak on forests now unused would appear likely to be a very important factor in provincial revenues. This revenue might be increased by the increased royalty procurable from bamboos if a cheaper means of extraction were provided by railroad. The development of the hardwood forests would probably proceed slowly, but, taking into consideration the world demand for the timber, the exhaustion of other areas, and the accessibility of the Burma forests, there appears no sound reason why the revenue from mixed hardwoods in Burma should not eventually rival that from teak.

The extraction of hardwoods by railway neither implies nor necessitates forest destruction. Under the conditions prevailing in the Tharrawaddy Division it appears that the introduction of the Uniform System might be accomplished at a profit, by the cutting and sale of mixed species if rendered accessible by railroad, whereas at present it is being accomplished at a great loss of valuable timber which is felled and which, owing to lack of means of extraction, must be left to rot on the ground.

Should it be desired to work the forest on the Uniform System for the regeneration of teak, cutting and extracting operations could be carried on over a compartment for two or three years in succession, or, if necessary, the felling might extend over a longer period. In that case it would be necessary to group three or four compartments to be worked over simultaneously.

Another silvicultural advantage would be that such areas as are not adapted for teak could be managed for the production of other species which, though valuable and useful, cannot now be considered because they will not float. It would become possible to consider the whole forest area valuable and revenue-producing to extend silviculture to cover all areas and all valuable species, and Burma would no longer be a one-tree Province nor Burma forestry a one-tree profession.

Extraction on a large scale by bringing to a common point a constant supply of logs of the various species suitable for the manufacture of matches, bobbins, tea chests, creosoted sleepers,

must precede the development of such manufacturing industries. The proprietor of a match factory can neither pay any one else nor undertake himself to cut over a forest in which scattered trees only are fit for his purpose ; the same holds true for the capitalist who would engage in the other industries, yet there are undoubtedly trees in the forests of Burma eminently suitable for raw materials for these industries. When the facilities are provided for the extraction of all species at one time, subject to silvicultural safeguards, timber will be made available at central points at such costs and in such constant quantities as to justify the erection of factories and the launching of those important industries which in other countries work up forest products.

If elephant and buffalo power continue to be available in sufficient quantities at the prices now paid, it should be possible to undertake the profitable extraction of mixed hardwood forests by railroad without the introduction of mechanical skidders. Nevertheless, mechanical skidders may, through the growing scarcity of animals, become necessary in the ordinary course of extraction in Burma. Under present conditions, where the felling schemes are on a small scale, only small areas are cut over at one time in one place. Where only one or two species are taken, the prospects of skidding machinery, even should it become necessary through lack of animals, are not favourable. On the other hand, should extraction by railroads be undertaken and if a cheap means of moving the skidder by railroad be provided, the cost of removing the timber could probably be reduced by the use of skidders with a resultant increase in royalty to the Government.

Undoubtedly one great difficulty confronting Forest Officers in Burma is the necessity for giving personal supervision with a small staff to many small scattered felling areas. Much valuable time is unavoidably lost on the road and a forester, as is perhaps the case everywhere, comes to the conclusion that he earns his living with his feet rather than his head. The concentration of felling schemes under areas worked by railroad would make possible a more intense supervision.

The possibilities outlined in this paper have been based on an impression gained by walking through fifty or sixty miles of forest and making ocular estimates of timber on average quarter acre plots. It appears well worth while to make a valuation survey of forty or fifty square miles of forest on an accessible area in such a division as Tharrawaddy, and if the amount of timber discovered justifies it to make an estimate of the cost of building and operating a railroad for the hauling of the timber, the estimate of the timber and the preparation of a stock map do not require the presence of a person experienced in railroad logging. The estimate of the cost of building and working the railroad with its branches, the detailed estimate of the cost and plans for the method of extraction and conversion should be made in conjunction with the District Forest Officer by some one conversant with railroad extraction.

The benefit to be gained by making accessible and profitable the great areas of hardwoods in Burma are so great financially, industrially and silviculturally, that it seems well worth while to spend on a valuation survey of timber available, and an estimate of the cost of extraction, the small sum necessary to determine the exact possibilities.

The great value of the teak forests should not be allowed to obscure the possibilities of the other species.

The suggestion has been made at different times that foresters from certain North American districts would find more to learn from a study of the work carried out on a large scale in India than from the more intensive operations in Europe. The writer is inclined to agree with this suggestion. No forester can come in contact with the professionally keen Indian District Forest Officer carrying on his work alone under personal discomforts unknown either in Canada or the United States without receiving inspiration. No forester can become acquainted with the sweeping accomplishments of the Indian Forest Service which, within fifty years, replaced forest destruction by the introduction of forest management over an area unequalled elsewhere in the world for difficulties, without acquiring a greater respect for his profession. One of the finest



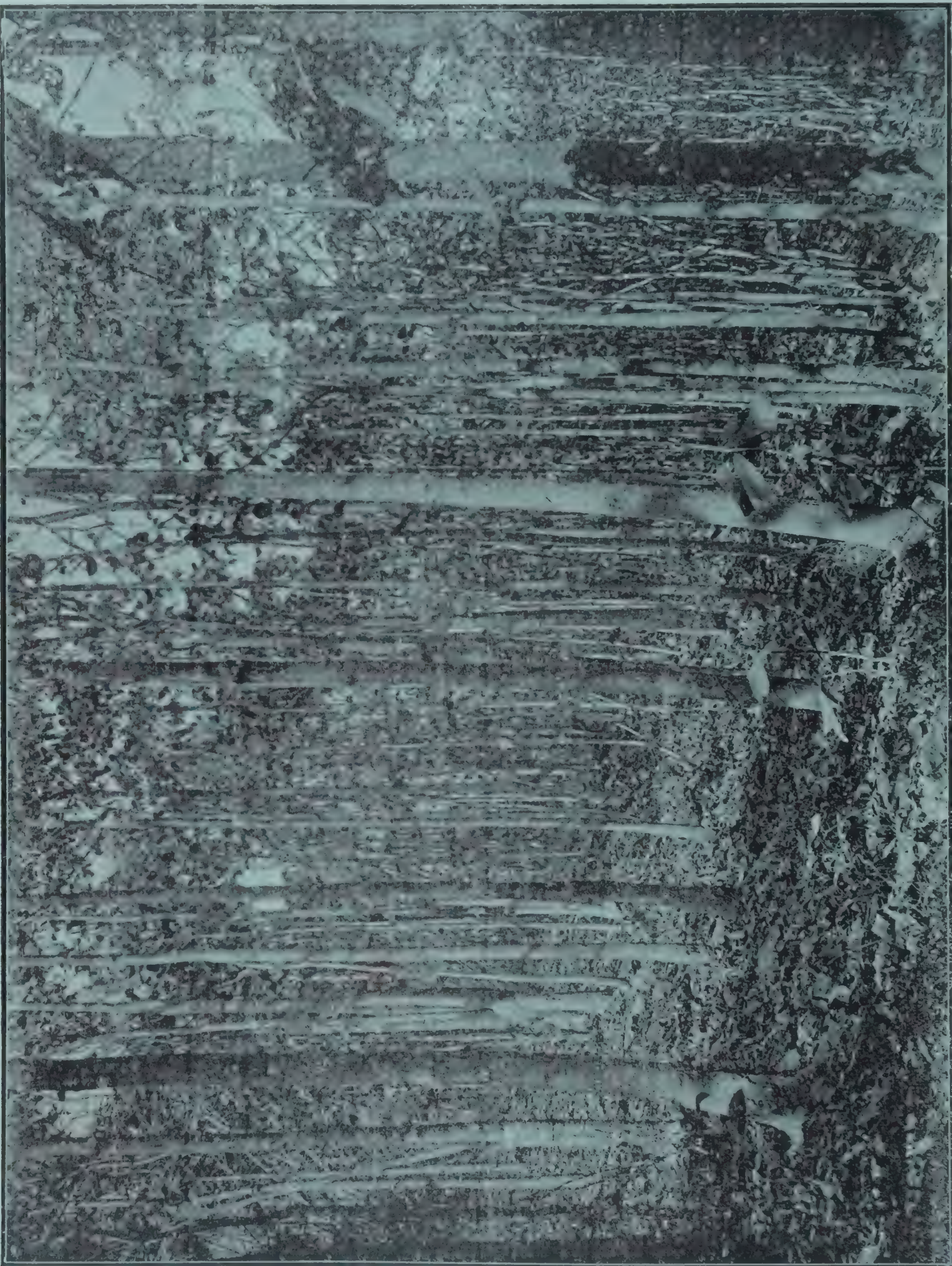


Photo Mch. 11. Dent. Thompson College. Rocker.

features of British administration in India must be that represented by the work of the two generations of Forest Officers, a handful of Europeans amongst three hundred million natives, whose every habit is opposed to the aim of forestry. That these few foresters in half a century should have brought forestry in India to the present stage, where practically destroyed forests are being regenerated and formerly inaccessible forests are being worked in such a manner as to demonstrate almost as well in Europe, the working of the various systems of silviculture, must appear to any visitor absolutely incredible. Foresters from India might also benefit by visiting North America. The home of forest destruction is likely to show the most economical methods of extraction and of manufacture. Foresters from Burma especially, where large areas of untouched forest yet exist, might, by visiting the steam logging operations of America, and the large well-organised saw-mills, judge more accurately than has been set out above, the greater possibilities of Burma forests.

FOREST GROWTH ON OLD SHIFTING HILL CULTIVATION.

BY A. RODGER, I.F.S.

The problem of how to replace the forests destroyed by *taungya* cutters is always of interest, and the accompanying photograph (Plate 46) shows a first-rate example of what nature can do unaided in its solution. This wood was seen in the Prome district in unclassed forest at an elevation of about 500 feet on the outer skirts of the Pegu Yomas, on the *Thithlagyaw* to the north of the village of Ngashinkwin. The slope was moderate, the soil fairly good loam, and bamboo (*Dendrocalamus strictus*) was scarce in the neighbourhood. The area had been cut over about 17 years before and the photograph was taken in December 1915, by which date the ground had been largely occupied by good dense pole growth. Three countings were made and the following figures obtained:—

Number of stems per acre	1,150
Timber down to 2 ft. girth : cubic feet per acre	165
Small wood : cubic feet per acre	1,108
Total	1,273

The volumes were calculated from sample trees of all sizes which were felled. Seventy-four per cent. of the trees were below one foot in girth and the largest measured $3\frac{1}{2}$ feet in girth at breast-height. *Stephegyne diversifolia* (Binga) formed 72 per cent. of the total crop and almost all the stems of this species measured less than 14 inches in girth. The species coming next in numbers were *Hymenodictyon excelsum* (Kuthan), *Bombax insigne* (Didu) and *Berrya Ammonilla* (Petwun), but there were only 25 of the last-named per acre. There was also a sprinkling of *Erythrina* sp., *Odina Wodier*, *Spondias mangifera*, *Lagerstræmia villosa* and a few others. The number of stems and volume per acre compare quite well with the same figures for a carefully tended teak plantation in the neighbourhood, 13 years old, in which there were 690 stems and 1,385 cubic feet of small wood per acre.

NOTE ON THE COLLECTION OF SAVANNAH GRASSES FOR PULPING EXPERIMENTS.

BY W. RAITT, F.C.S., CONSULTING CELLULOSE EXPERT, FOREST RESEARCH INSTITUTE.

In the published report on Savannah Grasses (Indian Forest Records, Vol. V, Part III), attention is drawn to the constitutional differences between various parts of the species dealt with in order to emphasize the greater value of flower culms. Thus the flower culm of *Saccharum Munja* was found to yield 42 per cent. of fibrous cellulose against 34 per cent. for leaf culms. The average for the whole plant came out at 40 per cent. showing that the greater proportionate weight of the former so far wiped out the lesser value of the latter as to make the distinction of little practical value. The samples dealt with were small in quantity and contained little or no *immature* leaf and probably the weather conditions prior to their harvesting were unfavourable to its production. Recent experience with grass collected on a considerable scale makes it desirable to issue a warning against *immature leaf*.

The character of the cellulose skeleton of a grass depends largely on the work the plant has to do and the forces it has to

resist and the excellent quality of the cellulose found in the flower culms of Savannah Grasses is due to the culm having to force its way to a considerable height above its leaf mass and there to carry an apparently top-heavy flowering head swinging freely in wind-swept spaces and resisting the beating down effects of wind and rain. The stem must, in a large degree, develop flexible rigidity, and it is just this quality of *flexible rigidity* which we readily recognize in the individual fibres of its cellulose skeleton. Wood cellulose does not possess it, for in the tree resistance to the elements is provided by highly liquified solid tissue.

The leaf culms have no such serious strains to resist; they do not rise to so great a height, they are massed in the clump to an extent which gives them mutual support and their cellulose structure is organized accordingly. It is inferior to that of the flower culms both in quantity and quality, but when it represents a growth of several months and therefore has had time to develop and mature, such inferiority is not enough to make a serious difference to either the yield, or its quality, of the whole crop. The case is very different with immature leaf, by which I mean short leaf of probably only a few weeks' growth crowding up the bottom of the clump and from twelve to thirty inches in length. In a normal season probably little of it will appear and the conditions that induce it may be a prolonged dry break of the rains in August—September followed by their recurrence for a short period prior to their final cessation, or, the interjection of a few wet days during the normally dry weather of the cropping season. The effect is a dense quick rush of short leaf which has its development immediately arrested by the recurrence of dry weather. When thoroughly sun-dried, it may be ground to powder by merely rubbing it between the hands and a material which behaves thus has no value as a cellulose producer.

Its effect upon the cellulose result of the whole crop would not be serious if it meant only a reduction of the average yield, but it goes further than that. Such cellulose, as it contains, has an abnormal proportion unorganized, *i.e.*, in true cellulose form, and that which is in fibrous form has only begun the organizing process

and is in tender non-resistant fibres of about 0.5 mm. length instead of the tough 2.5 to 4.0 mm. fibres found in the flower culms. Both forms break down during the digestion process into a viscous débris which agglutinates itself on to the good pulp and seriously interferes with the proper after-treatment of the latter. No pulp is of much use to the paper-maker unless it is what he describes as "free," a condition in which the individual fibres are capable of floating independently on each other and the precise opposite of agglutinated and matted masses. It also interferes considerably with the bleaching of the pulp being itself almost unbleachable.

Fortunately it is a simple matter to prevent the admixture of immature leaf. Whenever such growth is present I would recommend that it be left on the ground by grasping the whole cut mass of the clump at about four feet from the cut end and shaking the short stuff out.

DEMARCATON OF FOREST RESERVES IN BURMA.

BY A. J. BUTTERWICK, P.F.S.

1. According to the rules now in vogue, the following is the method usually adopted for demarcating forest reserves in Burma. The outer boundary is delineated by means of pillars or posts, boards, and blazed trees, whereas the inter-compartment boundary is marked by pillars or posts at the junction of two or more compartments, and blazed trees. This article is not concerned with boundary pillars or posts, but only with the system of blazing trees, which, in the writer's humble opinion, is neither desirable nor required. As a matter of fact, as may be seen from the accompanying photos (Plates 47—49), it is in some cases very injurious to the trees themselves.

2. The following are the rules which govern the blazing of trees for demarcation:—

"Trees under one foot in diameter should not be blazed if a sufficient number of larger trees are available. The blazes will be cut at a convenient height from the ground on the outer side of

Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.

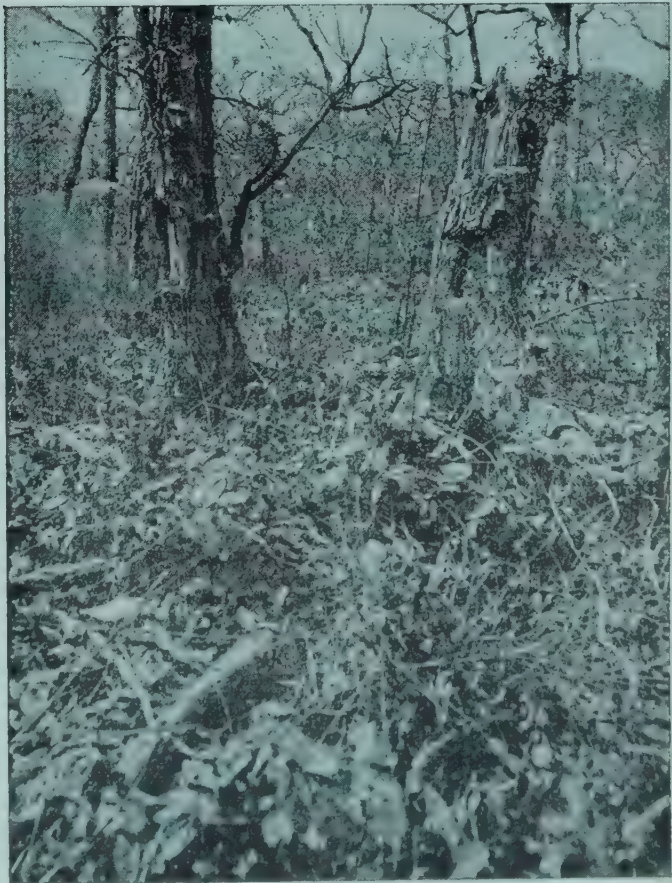


Photo-Mechl. Dept., Thomason College, Roorkee.

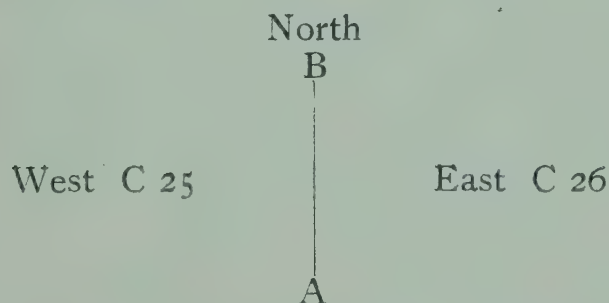
DEMARCATON OF FOREST RESERVES IN BURMA.

trees, on or within the forest as near as possible to the boundary line, and will face outwards. They should have a well and clearly cut face, both edges of which will be bevelled well back to delay occlusion, sufficient of the heartwood being exposed (in the case of trees having a distinct heart) to take at least three clean impressions of the demarcation hammer.

"Inter-compartment boundaries shall be blazed similarly to reserve boundaries, but the trees shall be blazed on both sides, each blaze being marked with the compartment hammer."

Again later orders on this subject are :—

"Blazes must face away from the compartment to which they refer ; thus in the diagram below, when walking north along the ridge AB, blazes marked 25 will be seen facing east and blazes marked 26 will face west.



"Several impressions of the number may be put in the centre of the blaze, and the C hammer put round it. To indicate places where posts have been put, it is advisable to have, say, three trees close to the post, on each line meeting at the post, blazed twice, one blaze above the other.

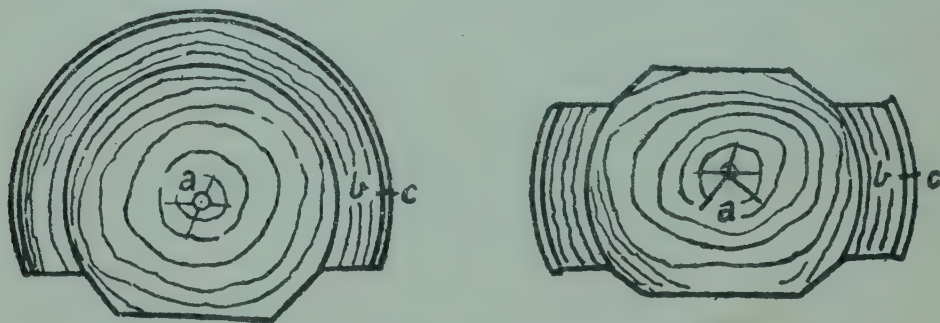
"Teak trees must never be blazed unless they are useless for timber or there are no other trees to blaze. Numbers should be struck on the heartwood. It is better to have a few large trees blazed than a large number of small trees ; as the latter often break and rot. From one blazed tree the next should be easily visible."

3. From the above rules it may be concluded that the following trees should not, ordinarily, be blazed :—

(a) Teak trees. (b) Trees under one foot diameter. (c) Trees without a distinct heartwood. (d) Trees some distance from the boundary line.

The officer doing the demarcation is, therefore, limited in his selection of trees to be blazed. Also it may be noted that in the outer boundary lines, trees will be blazed in one place, on one side only, except near pillars or posts, where a few trees are to be blazed in two places, one blaze being above the other. Along inter-compartment lines trees will be blazed on both sides, and it is surmised that near pillars or posts a few trees will be blazed twice on both sides. On the blazes along the outer boundary of the reserve the R hammer is marked, whilst on those along the inter-compartment boundaries, the C hammer, together with the number of the compartment, is struck.

The following sketches show the transverse sections of trees blazed on one and on both sides. The blazes have been splayed out according to the rules, to prevent rapid occlusion :—



a = heartwood. b = sapwood. c = bark.

4. The practice of blazing trees has two advantages, in that it not only demarcates the reserve, or compartment, but also serves to help one to find his place easily on the map. Besides it is a comparatively cheap way of demarcation.

It has, however, the following great disadvantages :—

- (a) The blazes are not permanent, as in anything from ten to fifteen years, they are completely occluded and the hammer marks are either obliterated or hidden from view.
- (b) Blazes injure the trees badly, as they not only vitiate their vigorous growth, and form misshapen boles, but also serve as entrances for harmful insects and fungi. Also in many cases trees deeply cut in are blown down by the wind. Further in Plate 48, Fig. 7,

Fig. 5



Fig. 6,



Fig. 7.



Photo-Mechl. Dept., Thomason College Roorkee.

DEMARCATON OF FOREST RESERVES IN BURMA.

it will be seen that the heartwood exposed by the blaze has been badly scorched by fire.

- (c) Repairs to a blazed tree are expensive as they have to be carried out comparatively often, if the demarcation is to be of any use.
- (d) As the hammer marks on the blaze are all in English characters, the Burmese "tawtha" coolies are, in the majority of cases, not able to read them or to know the number of the compartment.
- (e) As the outer boundary of the reserve is marked with the R hammer only, it is not possible for any one not thoroughly acquainted with the reserve to tell which compartment lies on the other side of the blazed trees.

5. To show the damage done to trees by blazing, the writer ventures to attach some photos (Plates 47—49) of blazed trees and the following remarks are here given to explain them :—

Plate 47, Fig. 1. The tree in the foreground has been blazed twice, the lower blaze being the more recent, about 12 years old. The tree on the left has been more recently blazed, about 6 years ago.

Fig. 2. This tree was blazed about 12 years ago. Occlusion has partly taken place and a cavity has been formed.

Fig. 3. A "Shah" (*Acacia Catechu*) tree blazed twice. The lower blaze is the more recent, about 10 years old. It has almost completely occluded.

Fig. 4. The stump on the right belongs to a tree, which was blazed too deeply and which was blown over. The other blazes were done about 9 years ago.

Plate 48, Fig. 5. This tree shows an occluded blaze made about 11 years ago.

Fig. 6. This tree stands near a boundary pillar and shows the two blazes (about 4 years old) required under the rules.

Fig. 7. A very large blaze, partly occluded, and a misshapen bole are shown here. The blaze is about 5 years

old. The heartwood has been badly scorched by fire.

Plate 49, Fig. 8. This shows the injury done to a tree by a blaze 4 years old.

Figs 9 & 10. Both these photos show the same tree with two blazes, the lower of which is the more recent, about 4 years old. The bevelling back of the two sides required under the rules is clearly shown here. The hammer marks on it are not distinct.

The above photos are of trees which have been blazed on one side only. The writer has not yet seen trees blazed on two sides according to the rules. It will be readily agreed that the serious injuries done by this one-side blazing will be enormously increased by the two-sided cutting.

6. When a blazed tree is repaired, either the old blaze must be opened out and deepened, or else a new blaze be made either above or below the old one. This may be seen in several of the accompanying photos. After the tree has thus been repaired two or three times, its vitality is bound to have become so impaired that it will either be killed and rot away or else be blown down by a strong gust of wind. It may be contended that in the forests of Burma there are so many trees along the boundaries that if one falls there is always another to take its place. But as stated above in paragraph 3, the demarcating officer is limited in his selection of trees for blazing. Further, there is an increasing demand for good timbers besides teak, and, as in the case of teak, this demand will not allow any tree of the more valuable species being blazed for demarcation purposes. It is just these valuable species then, which, having a durable heartwood, are able to bear the heavy blazing for some time. Other inferior species soon get fungus or insect ridden, and in a short time become hollow and rotten.

7. In the writer's opinion, instead of blazing the trees as is done now, demarcation should be done in the following manner:—

(a) Along the outer boundaries "Asoya (३० 8: १)" boards, as used at present, should be placed every 20—50

Fig. 8.



Fig. 9.



Fig. 10.



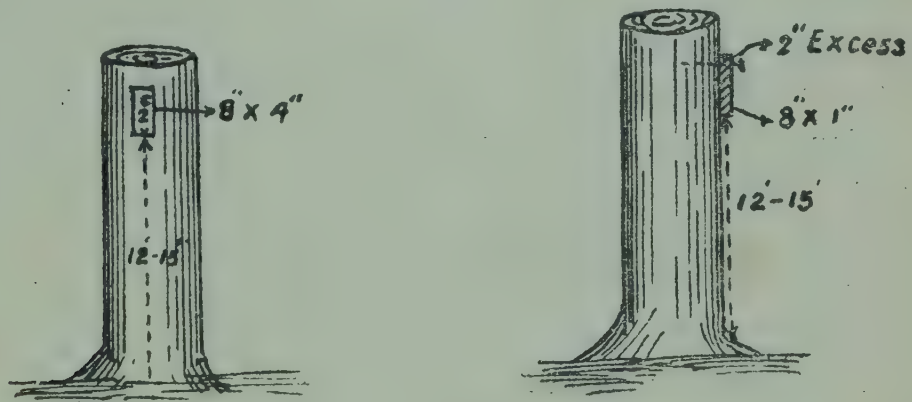
Photo-Mechl. Dept., Thomason College, Roorkee.

DEMARCATON OF FOREST RESERVES IN BURMA.

yards apart, the distance depending on the locality of, and density of growth in, the forests. These boards will be nailed about 12—15 feet high on trees, to be out of the reach of elephants. They should be made as at present, except that the letters should be stamped on them by means of marking hammers. The letters will then be filled in with black paint.

- (b) Along both the outer and inter-compartment boundaries small boards should be placed high up on trees about 10—50 yards apart. Each board will be 8" x 4" x 1". It will be painted white and have stamped on it, by means of iron dies, the letter C, and the number of the compartment in English and in Burmese numerals. These will be painted in with black paint.

Below a sketch is given to show what is meant :—



From enquiries made it is estimated that the cost of each such board, including its fixing up on the tree, will not exceed annas four.

The advantages of having these boards, instead of the blazing, are manifold :—

- (a) The trees are not injured in any appreciable manner.
- (b) Small trees of inferior species can be used and the more valuable trees left alone.
- (c) Adjacent compartments can easily be marked on the same tree.

- (d) The numbers and letters having been sunk into the boards, they will be practically permanent, and will last as long as the timber does.
- (e) The boards, having been placed high up on the trees, will be more easily seen than the blazes, which are lower down.
- (f) Burmese coolies will be able to read the numbers of the compartments.
- (g) The outer boundaries will have the respective compartment numbers marked along them.
- (h) The demarcation lines will not require repairs as often as they do now.

The disadvantages of the system now advocated, appear to be—

- (a) the cost of demarcation will be much higher ;
- (b) the boards are apt to be broken, burnt, or stolen.

Regarding the first, this is fairly well counterbalanced by the diminished cost in repairs and by the fact that the trees are not injured in any appreciable way. Besides, in the writer's opinion, the demarcation will be much more distinct and therefore more valuable and efficient. Regarding the second, the writer has taken notes of the "Asoya" boards, used at present, for the outer boundary, and he has found that a very small percentage of them is lost in this way. It may also be contended that, as regards the outer boundary, the boards may easily be taken off and nailed on to trees much further in, thus encroaching on the forest reserves. This, however, is not likely to happen, as with the boundary notifications, maps and records in use in every Divisional Forest Office, there is always a sufficient check in hand. In the many forests in Northern India, visited by the writer, blazing of trees was never done to demarcate the reserves, and in those parts of the country the population was far denser and the land comparatively more valuable than in the majority of places in Burma.

NOTE ON GOLPATTA.

BY BIJAY KUMAR BHATTACHARJI, FOREST RANGER.

Golpatta (*Nipa fruticans*) is not only the most important article of minor produce of the Sundarbans Forests, but is one of the most important and most valuable of the minor products of Indian Forests. Out of the 6 lacs of annual revenue from the Sundarbans, more than a lac of rupees is derived by selling the Gol-leaves.

Locality.—It is found growing luxuriantly on the margins of all rivers and khals in the Sundarbans as far as saltiness pervades their water. In fact, the presence of sufficient quantities of salt seems to be a *sine quâ non* for its existence.

It forms a sort of fringe to the Sundarbans Forests, but seldom penetrates deep into them. It thrives best in the tract of land lying between the low and high water-levels, at ebb and flow tides respectively. Occasionally it is found extending a little above the tide-mark, and entering into the forest. As the saltiness in water diminishes, its place is taken by its fresh-water kindreds—cocoanut (*Cocos nucifera*), betel-nut (*Areca Catechu*), date-palm (*Phoenix sylvestris*), and palmyra (*Borassus flabellifer*) which form beautiful groves along the banks of all big rivers of the Khulna and Backergunge districts. Indeed, it is a pleasant journey through these rivers along the avenues of these palms just before sunset when the crowns of all these tall palms are still illuminated by the rays of the setting sun, giving them, as it were, the appearance of a row of chivalrous princes, setting forth in battle array with their glittering golden crowns.

Soil and Climate.—It grows best in alluvial deposits of clayey loam with an admixture of sufficient quantities of common salt. It is only suited to tidal regions. During flow tides, the whole plant, with the exception of a few tips of leaves, is buried in water. This peculiar habit whereby a part of the stem remains submerged in water for a few hours every day, makes Golpatta independent of rainfall. A considerable amount of heat as well as the direct rays of the sun, are necessary for the germination of the seed and the development of the seedling.

Shape and Development.—Golpatta has no over-ground stem though it develops a considerable so-called rhizome under-ground. This under-ground stem, which is thick and fleshy and densely packed with reserve food materials, broadens near the surface of the ground, whence the leaves develop. As in other palms, the new leaves are plicately folded into long cylindrical spears. As they grow older, the folds untie, the leaflets spread out and the leaves attain their normal full-fledged form.

The leaves are fibrous and the rachis strong and heavy. If left to itself and uncut for some years, the rachis becomes extremely heavy and unwieldy, so that purchasers do not like to cut it. Frequent cuttings give tender rachises and finer leaflets—much sought after by purchasers. The leaves, in favourable localities, attain a height of 12 to 18 feet.

Golpatta is a light-demander and is fairly fast growing. It takes about 18 months to 2 years from the germination of the seed to the time when the leaves are fit for cutting.

The green wood has about the same specific gravity as fresh water and will not float in it, though it does float in salt water.

Reproductive Power.—It bears fruit annually. The inflorescence is an oval-shaped terminal spadix covered by a thick, fibrous spathe. The infructescence is also covered by a sheath when young. The fruit is a ribbed, obovate drupe. The seed is enclosed within a fibrous rind—the kernel being covered by a hard osseous shell.

The flowers are formed in March and April, and the fruit ripens by the next February or March, when it is fit for collection. The percentage of fertile seeds, however, is small. Germination is very rapid and is independent of all extraneous circumstances. The young shoot is sometimes seen peeping forth as soon as the fruit falls. Reproduction under the parent tree is seldom effected by seeds. The rhizome, however, is very active in sending forth new flushes of leaves as soon as the old ones are removed.

Character and composition of the Forest.—It grows in pure compact masses along the banks of channels—sometimes alternating with patches of mixed forests composed of Hantal (*Phoenix*

paludosa), Hargoza (*Acanthus ilicifolius*), Bhola (*Hibiscus tiliaceus*), and in some places Udoban (*Acrostichum aureum*), Sundrilota (*Derris sinuata*), Kewa (*Pandanus fascicularis*), and Nal (*Phragmites Karka*). Of these Hantal affects the same sort of locality as Golpatta and also forms pure crops. The compact groves of Golpatta are favourite resorts of tigers during the hot noon-day sun.

Method of Treatment.—It is at present treated as minor produce and sold by permits. But though its present abundance does not warrant any regular method of working, still as the demand for it is gradually increasing, a time will soon arrive when some regular method of treatment will have to be prescribed for the working of this valuable species. As the rachis becomes tender and the leaflets finer by frequent cutting, the method of simple coppice or clear felling may be suitable for it.

As the forest is by itself clean and pure, no subsidiary operation is necessary.

Method of Extraction and Stacking.—Golpatta, like everything else in the Sundarbans, is transported by boats. These boats have to pay royalty according to their capacity in maundage by boat measurement.

Formerly, after cutting, the Gol-leaves were spread on the banks for drying, so that they might be lighter and occupy less space. This custom is now disallowed, as it means a loss to the Government, as much more leaf could be loaded in a boat by that process. Clever purchasers, however, throw away the rachis, which is useless, as well as the heaviest part of the leaf. The leaves are then spread to their full size and stacked one above another either on a wooden platform, made for the purpose, or from the bottom of the boat, to the maximum height, commensurate with the safety of the boat during storms. Tiers of Gengwa (*Excoecaria Agallocha*) logs are introduced at intervals to press down the leaves. Gengwa jhools are also put at water-level along the sides of the boats, in order to steady them, as well as to counteract the force of the wind striking against the high stack of leaves. As in the case of all other vessels, these boats can ply up or down with the tide and never against it.

Economic Uses.—The peduncle of the newly-formed flower is eaten raw or cooked. The kernel of the fruit, before the stone hardens, is sweet and is greedily sought after by children. The ripe kernel is being experimented with for button-making, and if the experiments are successful, there will probably be a large demand for it. However, the most important part of the plant is the leaf. It is extensively used as a roofing material. Most of the houses of the poor in Calcutta and the suburbs are roofed with it. It is also largely used for rough-walling, umbrella-lining, basket-making, mat-making and the like purposes. The rind also yields a fibre, which, but for its shortness, might be a useful substitute for coir-fibre. A fibre may also be extracted from the leaves and leaf sheaths.

BEE-HOLE BORERS AND A TUCKTOO.

BY A. R. VILLAR, I.F.S.

During the month of April I was placed on special research work on the Bee-Hole Borer in the Bhamo District. For the benefit of the uninitiated it may, perhaps, be necessary to explain that the so-called Bee-Hole Borer has got nothing to do with bees but is a large moth (*Duomitus ceramicus*), the caterpillar of which tunnels a gallery in the heartwood of teak some 8—10 inches long.

After some preliminary investigations I finally settled down at Okchi, on the lower Kaukkwe river, where I had found a small area of pure natural teak forest to be very badly infested with the pest.

The first emergence of the moth took place on the 21st April, on which day a pupal skin, just clear of the thorax, was found sticking out of a teak tree. On the 23rd April between 1 and 3 o'clock in the afternoon a large female moth emerged from a piece of teak wood which I had tied up in the Rest-house and enclosed in a mosquito netting cage. This moth was transferred to an ordinary camp cot mosquito-net which was fixed up in the corner of the western bed-room. An ordinary Burmese grass-mat or *Thinbyu* was placed on the floor beneath the net to stop

anything getting through the cracks of the floor and the ends of the net were held firmly down to the floor by means of the weight of bamboos.

On the evening of the 26th April, shortly after 8 o'clock a large moth flew in at the verandah of the Rest-house and after flying round two or three times settled on the mosquito-net exactly opposite the place where the large female moth had taken up its position on the inside of the net. It was easily captured and closer examination proved it to be a male *Duomitus ceramicus*. Previous to this the female had been very quiet. Now, however, both moths were rapidly vibrating their wings, producing a low humming sound, more audible in the case of the female owing to the larger size of the wings. Soon after this I noticed that the female had laid an irregular row of eggs on the top of the net. I cannot state positively whether the eggs were laid before the arrival of the male. If so it could only have been a short time before. In any case no pairing took place, for the eggs were sterile. The female which is provided with an ovipositor about an inch long continued laying eggs about the net in rows and masses, frequently pushing the ovipositor through the holes of the netting but taking no notice of a freshly cut piece of teak which I put in the net.

On the morning of the 22nd, just before 11 o'clock another moth (of my captive specimens) emerged from a specimen of teak wood kept in the bungalow and proved to be a male. Its wings, however, never developed properly as the pupa had apparently been damaged. This moth was also transferred to the mosquito net and during the day-time all the imagos remained motionless becoming active again in the evening, vibrating their wings and the female continuing to lay sterile eggs.

On the night of the 27th, about 11 o'clock I caught another male moth under almost identical conditions as on the 26th. As instances of sexual attraction, these two cases are probably unique.

To capitulate, therefore, I had now in the mosquito-net three male moths and one female, on the night of the 27th. Two of these moths, the female and the damaged male, emerged in captivity during the day-time (apparently normal), the other two males

being captured at night outside the mosquito-net to which they had been attracted by the female. On both nights the female, in the presence of the males, laid quantities of sterile eggs. The moths appear to be active at nights only.

Early on the morning of the 28th I went to see how my captures were progressing, when to my dismay, I found only the remains of wings. They could, therefore, not have flown away nor indeed was it possible for them to get out of the net. Further examination revealed a tear about two inches long at one end of the net near the bottom just above the cotton border. My first thoughts suggested rats, but this theory was clearly untenable. My next idea was the Taukte (anglicised tauktoo), which lived behind one of the posts in the other bed-rooms of the Rest-house. On asking some Burmans they immediately suggested a taukte as the miscreant. An immediate onslaught was, therefore, made on the taukte behind the post. By means of hot water poured down from the top of the post accompanied by the prodding of several Das (Burmese long-bladed knives) he was eventually dislodged from behind one of the scantlings, securing the end of the split bamboo wall behind the post and quickly killed, being somewhat mutilated, I am sorry to say, in the process. Examination of the contents of the stomach confirmed my suspicions, for it was undoubtedly full of the remains of my moths. He had made this hole, scotched all my moths and then got out again through the same hole. He must also have eaten some of the eggs, because the first row about 2 inches long laid by the female had also disappeared. This moth was in the habit of resting near or over this row of eggs (no doubt to protect them), and the probability is that she was near them when attacked by the tucktoo. One of the things which have still to be ascertained is the cause of the high rate of mortality of *Duomitus ceramicus*, for each female moth lays between four and six hundred eggs. I think, after this experience, we can rightly class the tucktoo (*Gecko* sp.) as one of the enemies of this pest and a true friend of the forester in Burma.

CORRESPONDENCE.

TO THE HONORARY EDITOR, *Indian Forester*.CLEANINGS, IMPROVEMENT FELLINGS, AND
THINNINGS.

SIR,—With reference to Mr. Smythies' letter in your June issue, I wish to point out that, sylviculturally, there is no distinction between my cleanings and thinnings. Cleanings are thinnings carried out in crops of 5th class trees, *i.e.*, those six inches in diameter and under. Cleanings are carried out by forest guards while thinnings by more highly trained subordinates. These two operations were, I believe, considered as distinct when I was in Germany. At any rate, the two terms are well known in this division and there is no difficulty whatever about the term "Cleanings" which is known to every forest guard.

Improvement fellings consist in cutting, lopping or girdling oaks and broad-leaved rubbish in the interests of coniferous trees and also in removing diseased kail or fir in favour of deodar.

Minor improvement fellings consist entirely in clearing the area under regeneration of such rubbish as *Pieris ovalifolia* and rhododendron and subsequently in keeping the young crop free from such stuff.

No great advantage appears to be gained by an attempt to obtain a definition applicable to the whole of India. It surely suffices that the exact meanings of the term used should be well understood in the division where it is employed. The definition adopted is really immaterial, the important thing is to get the work done.

DATED KULU :
The 16th July 1916.

}

C. G. TREVOR,
I. F. S.

CLEANINGS, IMPROVEMENT FELLINGS, AND THINNINGS.

SIR,—It is clear from articles and letters recently published in the *Indian Forester*—notably Mr. Howard's article in the February number, Mr. Wood's reply thereto, and Mr. Smythies' letter of the 6th March in the June number, 1916, that there is a striving after standard definitions of forest terms in common use. May I venture to suggest the following definitions of the terms "Cleanings," "Improvement Fellings," and "Thinnings." I am aware that the definitions are somewhat revolutionary, and that they depart somewhat widely from past practice. At any rate, they are doubtless capable of being pulled to pieces, and perhaps that process will result in the building up of standard definitions which will be, at the same time, accurate and generally acceptable to Forest Officers in India.

The three definitions are as follows :—

- (1) Cleanings are operations, carried out in *pure crops or in mixed crops, of which the component species are all of real economic value*, the crops being of all ages from small saplings to mature trees. Their object is the removal of all trees which are suppressed, malformed, seriously damaged, or diseased; provided such trees are not required for soil protection purposes.
- (2) Improvement fellings are operations carried out in *mixed crops, of which the component species are some of real economic value and others of no economic value*, the crops being of all ages from small saplings to mature trees. Their object is the removal of all trees of the valueless species which are interfering with the normal development of trees of the valuable species.
- (3) Thinnings are operations carried out in *pure crops or in mixed crops, of which the component species are all of real economic value*, with the object of allowing individual trees of the future (from the sapling to the

mature tree) sufficient room to develop in accordance with the objects of management without, however, permanently interrupting the leaf-canopy. The operations involve the removal of trees in themselves comparatively healthy, and well-grown, and which could not be removed in "Cleanings."

R. PARNELL,

CAMP *via* ABBOTTABAD, N.-W. F. P.: } *Deputy Conservator of*
17th July 1916. } *Forests.*

EXTRACTS.

SOME USES OF PRICKLY-PEAR.

The Director of Agriculture, Madras, has issued, in the form of a departmental leaflet, the following Note on some uses of prickly-pear :—

The prickly-pear plant is considered by many ryots as a curse to the country, as it has overrun immense areas in several villages. In some places, much agricultural land has been rendered temporarily useless from having been taken possession of by this troublesome pest. In very many villages, the scrub jungles are overgrown with it and the land which would have otherwise been useful for growth of trees and grasses is occupied by it. It forms a safe refuge for snakes, etc. By the spread of this plant several public thoroughfares are becoming narrower every year, whilst poramboke (waste) lands are not infrequently rendered useless thereby for any purpose. The ground close to these bushes is used as a public latrine by villagers which encourages the growth of the plant and does not add to the amenities of the village. The eradication of prickly-pear in villages is therefore one of the serious problems with which ryots have to contend.

Although attempts are being made here and there by public bodies such as taluk and district boards to eradicate this plant in

very congested areas, yet such work is only practicable on a large scale if ryots in all the villages assist in removing it.

In parts of Coimbatore district, prickly-pear is used after decomposition and composting as a manure for dry land crops such as cumbu, cholam, dry ragi and garden crops like ragi, chillies, tobacco, wheat, plantains, sugarcane, etc. This is, however, not resorted to by all. In many cases it is prickly-pear growing in corners of their fields or extending from outside into the fields that is cleared and composted by way of disposal. A few ryots compost prickly-pear especially when it is abundantly available near at hand ; but this is not followed as much as it might be.

Ryots, however, have taken up to the practice of carting to their fields the earth which accumulates under prickly-pear bushes for improving their lands. In tank bunds and porambokes, nothing is paid for the earth itself, and the cost is only two annas per cart-load (when the distance to be carted is about half a mile), for clearing the prickly-pear to get at the earth beneath, digging the earth, loading and carting it to the fields. The price per cart is becoming higher gradually owing to the increased wages. The soil under the prickly-pear bushes is of high manurial value as it is very largely composed of leaf-mould and other organic matter blown in by the agency of wind. Prickly-pear itself contains more than 60 per cent. of organic matter (Dr. Leather's analysis), and if such a substance is composted with the rich soil found under these bushes the manurial value will certainly be enhanced. Many of our soils are deficient in organic matter, and if a compost of prickly-pear and the soil found under it is made and applied, the result will be beneficial. By composting prickly-pear, ryots not only obtain manure but get rid of this pest which is at present a nuisance in many respects.

The following methods may be adopted for composting :—

(1) A trench 3' to 4' deep and 6' broad of any required length may be dug and kept ready during the interval between the first and second monsoons. During rainy days when the ryots have not got busy work, prickly-pear may be cut, removed and filled in the trench and covered with soil that has been removed in

digging it. The top of the trench will sink after some days owing to the decay of the stuff and at this stage the soil from under the removed bushes may be dug and thrown on the top. In places having good rainfall, this will make a good compost within one year. If the thorns have not decomposed thoroughly, this may be left for another year when the thorns also will decompose.

(2) In regions of scanty rainfall, prickly-pear may be removed and heaped up in convenient mounds and allowed to dry up during season when ryots have enough leisure at their disposal. Dried bushes, grasses and other rubbish procurable in the vicinity may be spread over the heaps and set fire to. The thorny substance is partially burnt. At this stage the earth removed from under the bushes or from lands close by should be spread all over the heap which can then be left for some years until decomposition is complete. In three or four years, this will be fit for being carted to fields.

(3) If space is not available for the above, circular constructions similar to those used for grinding chunam should be made. The prickly-pear is then thrown into this pit and ground by a stone grinder just as chunam is ground. Owing to the large amount of water in the stems the plant, when the stuff is ground, is converted into a jelly-like substance within half an hour and the whole mass can be removed by mammuties and carried to places where compost is to be made. If this is filled in pits or covered with some earth, decomposition will easily set in. The thorns also will not stand erect but will lie flat and the nuisance they cause will be much reduced. In this case the manure will be ready within six to eight months.

Prickly-pear can also be used to serve other useful purposes than the one above referred to. The water obtained after boiling prickly-pear for some time can be used as a drier in white-washes. An ordinary pot or chatti is filled with prickly-pear cut into small pieces ; as much water as the pot will hold is then added. The whole is boiled for about three hours and stirred during the process. When cool, the liquid is strained and added to separately prepared white- or colour-wash in the proportion of 1 to 150 or 160.

White-wash or colour-wash treated in this way becomes fast and does not rub off easily. In Indian houses this fast colour is a great advantage as it does not soil the clothing or body when the newly white-washed walls are touched.—[*The Indian Trade Journal.*]

DRYING AND CONSERVATION OF TIMBER BY ELECTRICITY.

According to a report in a Swiss technical building trade publication, *Hoch und Tiefhan*, a method of drying and conserving timber by means of treatment by electric current, which we feel sure will be followed with much interest by readers of this Journal, is being tried on the Continent with success. According to the report the effect of passing a strong electric current through freshly-cut timber causes a chemical change producing rapid oxidation of certain parts, combined with a physical change in the cellulose and its numerous derivatives which renders them better able to withstand the action of fungi, while increasing its suitability for mechanical use ; it also confers an aseptic quality to the sap elements remaining in the timber. The Nodon process, as it is called, is claimed to be so effective that in a few hours a thorough oxidation of the wood-sap takes place, a process which, in free air, would require several months ; the process reduces the hygroscopic tendency of the wood so that it no longer readily absorbs moisture. The process can be applied to green timber with such success that in a few weeks a thorough seasoning takes place ; while in the like period similar timber untreated by process will be hardly surface-dry. A certain amount of moisture helps to carry the electric current through the timber so that the process is best applied to timber in a not too dry condition, in fact, as soon as practicable after felling. It can be applied in the forests where the felling takes place, thus reducing transit weight. The electrical energy required is 3 to 6 kilowatts per cubic metre.—[*Indian Engineering.*]

MACHINE TREE-PLANTING.

The mechanical tree-planter put in operation in Wyoming County, N. Y., under the supervision of the Forest Service, transplants 10,000 to 15,000 forest-tree seedlings daily, and is stated to work in any land not too rough to be ploughed and harrowed. The machine, about as large as the common mowing machine, is drawn by two horses, while one man is required to drive and two more to handle the plants. A furrow is made for the trees, which can be placed at any required distance apart in the row and the place for dropping each one is indicated by an automatic device. The soil is pushed around the roots and firmly rolled by the metal-tyred wheels. Water and fertiliser are applied to the roots of each seedling by two special attachments, and another attachment marks the line for the next row. Considerable saving in cost is claimed, one man setting by hand an average of 1,200 to 1,500 plants per day.—[*Capital*.]

PLANTING OF EUCALYPTUS.

In the Report on the Government Botanical Gardens, Saharanpur, for the year ending 31st March 1916, we find the following note on the Eucalyptus plant:—"Continued attention has been given to this class of plants, specially in view of the interest that appears to be now shown by the Railway Board, who has suggested this class of plants for planting on waste lands belonging to Railways. The diverse conditions under which species of this family will grow, and the varied uses to which they can be put, make them all the more valuable and interesting for study and experiment. The main point is to ascertain which species will flourish under the very varied conditions to be met with in India. Only actual trials under such conditions will enable us to know this. For example, out of several species sent to Ajmer for trial by the Bombay, Baroda and Central India Railway, it has been found that the best to flourish is *E. tereticornis*, a species that has been supposed to do best in fairly moist or even wet soils, yet in

Ajmer it flourishes on dry sandy soils. Out of some trials on different conditions of soils on the Laksar-Hardwar branch of the Oudh and Rohilkhand Railway, the following has been reported to do best on:—A. *Dry or stony ground*—*E. punctata*. B. *On ordinary ground*—*E. paniculata*, *melonophloia* and *microcorys*. C. *On swampy ground*—*E. rudis* and *robusta*. Out of the 54 species under trial at Saharanpur, the relative positions are : good 19, fair 16, bad 18, as compared with 14, 28, 12 in the same order the year previously. This shows, as may be expected, that the 'Fair' will gradually be eliminated, resolving into either 'Good' or successful, and 'Bad' or failures ; when this is completed we shall then have an authentic record of the successes and failures of those that have been tried. At Dehra Dun the following species seem to be well established, *viz.*, *E. bicolor*, *botryoides*, *microcorys*, *patentinervis* (which is giving seed), *rostrata*, *rudis* (also seeding), *saligna*, and *sideroxylon*. It may be of value to note that of these *E. bicolor*, *botryoides* and *sideroxylon* are reckoned as failures at Saharanpur, which proves that it is impossible to judge a species by trial at one place alone. So far it may be said that the most successful species generally are *E. citriodora*, *microcorys*, *obliqua*, *paniculata*, *punctata*, *robusta*, *rostrata* and *rudis*. Of these *E. microcorys*, *obliqua*, *punctata* and *rudis* are comparatively new species to India, and perhaps the most successful of these is *E. rudis*, which has not only proved the most successful here, but also at Lucknow and Lahore. The following eight new species have been added this year, and will be subject to the same trials as the others, *viz.*, *E. bosistoana*, *consideniana*, *corymbosa* *var. terminalis*, *exerta*, *maculata*, *pulverulenta*, *salmonophloia*, and *viminalis*."—
[*The Indian Trade Journal*.]

WOOD FLOUR.

Wood flour is ground or milled wood that has been screened so as to remove coarse particles and also to give particles having some uniformity in size. Wood flour is usually sold at 40, 60 or 80 mesh, although one large foreign purchaser has the following specification for dynamite flour:—

20 per cent. must pass through an 80-mesh screen.

50 per cent. must pass through a 60-mesh screen.

100 per cent. must pass through a 50-mesh screen.

The different properties of a good wood flour are: 1st, it must be white; 2nd, it must be light and fluffy; 3rd, it must be absorptive.

All industries in which wood flour is used (and these will be considered in greater detail later) require a white or very light cream-coloured flour, although absorptive qualities are demanded in a large degree only in dynamite flours. Colour and weight considerations, therefore, limit the species of wood which may be used to the white, light, non-resinous conifers and to the white, broad-leaved woods like aspen and poplar. Spruce, white pine, and poplar are the species most often used. The wood must be barked before grinding, and round wood, slabs (barked), and saw-dust free from bark may be used.

The grinding of the wood is performed in two distinct types of apparatus, either stone mills or steel burr roller mills. In Europe, particularly Scandinavia, where a great deal of wood flour is made, the stone mills seem to be used exclusively, and most of the early plants in this country use this type of mill. The stones are from 40 to 60 inches in diameter and only the lower stone is driven, the upper one being stationary. The mills are driven with water power turbines, since flour produced with other sources of power cannot compete with Norwegian flour ground by water power.

The wood, after barking, is first reduced to chips by means of the usual type of chipper or hog. These chips, along with a certain proportion of the screenings, are fed to the mills, which

are completely enclosed (with the exception of an opening at the top) with an iron or steel cover. Sufficient steam or water is added to prevent firing, and also to keep down the dust. The fine stuff from the mill is then drawn or blown through iron pipes or sheet metal ducts to the screening apparatus, which may be of several types, and which may be either bronze wire or silk bolting cloth, for both are used. After screening, the flour is packed either in compressed bales (the imported material comes in this way) or else is sacked with automatic sacking and weighing machinery.

Mills of the above type require from 45 to 50 horse-power per 24 hours per ton (from 1,200 to as high as 1,500 h.-p. hours per ton) of flour produced, the power requirement being about the same as in the production of mechanically ground wood-pulp.

Another type of mill was developed on the Pacific coast about twenty-five years ago and was designed specially to handle saw-dust as a raw material. This grinder consists of a number of pairs of corrugated chilled steel rolls which turn towards each other. One of the rolls rotates three times as fast as the other, thereby actually cutting the saw-dust which comes between them. The slower roll has its corrugations arranged so that they form pockets to hold the dust, while the faster roll does the cutting. There are three stands of rolls, the corrugations being progressively finer on each stand.

The saw-dust is screened before reaching the first rolls, so as to remove slivers, small blocks, etc. It is then passed over a strong electric magnet to pick out any particles of iron or steel present, and is also screened through bolting cloth between each pair of rolls to remove material of suitable fineness. The production of wood flour from saw-dust in this type of mill requires only from 20 to 25 per cent. of the power required with the stone mills.

Before the war, Norwegian wood flour was delivered at our Atlantic ports for from \$12.50 to \$15 per ton, and domestic material sold in competition therewith. The domestic production is largely controlled by one concern, although mills are scattered

all over the country from Maine to California, wherever the combination of proper wood and water power is available.

The principal uses for wood flour are in the manufacture of dynamite, linoleum, artificial plastics and flooring, and as an inert absorbent in many industries.

A dynamite flour must be both white and highly absorptive. Since dynamite darkens with age, a light-coloured stick is indicative of fresh stock, and trade demands, therefore, require the use of a white flour. For this reason it would be practically impossible to introduce the use of a wood flour produced from any coloured woods. A good flour should be capable of making a 60 or 70 per cent. dynamite (60 or 70 per cent. of the total weight being nitroglycerine) without permitting leakage or exudation of nitroglycerine. It is possible to improve the absorptive qualities and power of a flour by mixing it with water, boiling it actively for a short time, and then drying, although this process, of course, increases the cost of production appreciably. For dynamite purposes, therefore, wood flour must be as white as possible, it must be absorptive, and must be of the proper weight not only because the size of stick and number of sticks per box is standard, but also because too much flour cannot be used because it would disturb the carbon and oxygen balance in the explosive.

In the manufacture of linoleum, wood flour is used exclusively in the production of goods belonging to the inlaid class, either "granulated inlaid" or "straight-line." Cork linoleum is always dark, either the natural brown or dark red or green. Patterns are printed on cork linoleum, but the pattern soon wears off, leaving the dark base. For the production of inlaid goods, in which the pattern goes clear through the piece to the burlap backing, a white base is naturally necessary, not only to furnish a white background where desired, but also to permit of dyeing to any colour. For this reason a flour as white as possible is desirable.

For composition flooring, plastics, oatmeal paper, etc., the principal requirement is light colour, although in some cases certain species are necessary, as in the production of artificial bates for tanneries. The latter consists of a mixture of wood flour,

ammonium chloride and certain animal extracts, which are absorbed by the wood flour. Here again the trade demands a light-coloured product, and it has been found that flour from broad-leaved woods like poplar will cause a discoloration on storage, so that only flour from spruce or white pine may be used.—[*Timber Trades Journal.*]

GAZETTE NOTIFICATIONS.

1.—GAZETTE OF INDIA.

Nil.

2.—BENGAL GAZETTE.

2nd May 1916.—No. 11-For.—Babu Gurudas Chatarji, Extra Assistant Conservator of Forests, is granted privilege leave for three months, under Article 260 of the Civil Service Regulations, with effect from the 18th May 1916 or such later date as he may avail himself of the leave.

3.—BIHAR AND ORISSA GAZETTE.

25th April 1916.—No. 3-For.—Mr. R. G. A. Hannah, provisional substantive Extra Deputy Conservator of Forests, in charge of the Palamau Division, is granted privilege leave for three months, under Article 260 of the Civil Service Regulations, with effect from the 10th May 1916, or any subsequent date on which he may avail himself of it.

Mr. W. Breakey, Extra Assistant Conservator of Forests, attached to the Puri Division, is appointed to hold charge of the division during the absence of Mr. Hannah on leave.

4.—ASSAM GAZETTE.

22nd April 1916.—No. 1320-R.—Mr. W. A. R. Doxat, Deputy Conservator of Forests, is allowed extraordinary leave without allowance for six months, under Article 332 of the Civil Service Regulations, in extension of the leave already granted to him.

5.—UNITED PROVINCES GAZETTE.

21st April 1916.—No. 6-C.—Mr. J. N. Oliphant, Deputy Conservator of Forests, is posted to the charge of the North Kheri Division in the Eastern Circle, with effect from the 1st April 1916.

No. 7-C.—Mr. J. N. Oliphant, Deputy Conservator of Forests, in charge of the North Kheri Forest Division in the Eastern Circle, to hold charge of the South Kheri Forest Division in the same Circle, in addition, with effect from the 1st April 1916, as a temporary measure.

27th April 1916.—No. 8-C.—Pandit Urbi Datt, Extra Assistant Conservator of Forests, attached to the Chakrata Forest Division in the Western Circle, is transferred to the Naini Tal Forest Division in the Kumaun Circle as an attached Officer.

29th April 1916.—No. 9-C.—Lala Sita Ram Puri, Extra Assistant Conservator of Forests, attached to the Ramnagar Forest Division in the Western Circle, is transferred to the Distillery Division in the Kumaun Circle, as an attached Officer.

30th April 1916.—No. 10-C.—Mr. H. G. Ricketts, Manager of the Sleeper Works in the Kumaun Circle, is posted to the charge of Sleeper Division in the same Circle.

2nd May 1916.—No. 11-C.—On return from three months' privilege leave, Lala Ram Swarup, Extra Assistant Conservator of Forests, is re-posted to the Gorakhpur Forest Division in the Eastern Circle, as an attached Officer.

9th May 1916.—No. 19.—Mr. W. A. Bailey, Assistant Conservator of Forests, Sleeper Division in the Kumaun Circle, is granted privilege leave for six weeks, with effect from the 2nd May 1916.

No. 20.—Mr. W. A. Bailey, Assistant Conservator of Forests, on return from privilege leave, is posted to the charge of the South Kheri Division in the Eastern Circle.

12th May 1916.—No. 21.—Mr. D. Barrow, Extra Assistant Conservator of Forests, is posted to the North Kheri Division in the Eastern Circle as an attached Officer, with effect from the 1st April 1916.

No. 22.—Mian Muhammad Zia-ul Haq, probationary Extra Assistant Conservator of Forests, is posted to the North Kheri Division in the Eastern Circle as an attached Officer, with effect from the 1st April 1916.

20th May 1916.—No. 23.—Lala Ram Swarup, Extra Assistant Conservator of Forests, attached to Gorakhpur Forest Division in the Eastern Circle, is transferred to the Bahraich Forest Division in the same Circle as an attached Officer.

6.—PUNJAB GAZETTE.

19th May 1916.—No. 190.—Mr. L. B. Holland, Deputy Conservator of Forests, deputed to the Civil Department under Punjab Government Notification No. 13, dated the 6th January 1914, returned from deputation and assumed charge of the duties of an attached Officer in the Bashahr Forest Division on the afternoon of the 22nd *idem*.

24th May 1916.—No. 198.—On expiry of the privilege leave granted him in Punjab Government Notification No. 128-Forests, dated the 27th March 1916, Lala Jagan Nath, Extra Assistant Conservator of Forests, took charge of the Jhelum Forest Division on the afternoon of the 28th April 1916, relieving Mr. B. M. Warde, Extra Assistant Conservator of Forests, transferred to the Chenab Forest Division.

7.—CENTRAL PROVINCES GAZETTE.

27th April 1916.—No. 884.—Under Articles 233, 260 and 336 of the Civil Service Regulations, leave on medical certificate, combined with such privilege leave as may be due to him, for a total period of nine months, is granted to Mr. W. G. J. Peake, Extra Assistant Conservator of Forests, in charge of the Damoh Forest Division, with effect from the date on which he may be relieved of his duties.

No. 885.—Mr. Ghansyam Prasad Misra, Extra Assistant Conservator of Forests, attached to the Nimar Forest Division, is appointed to the charge of the Damoh Forest Division during the absence of Mr. Peake, on leave, or until further orders.

11th May 1916.—No. 37.—The one month and three weeks' privilege leave granted to Mr. E. Hore, Extra Assistant Conservator of Forests, in charge of the Bihar Range, Balaghat Division, in this office Orders No. 7, dated the 24th January 1916, and No. 24, dated the 8th March 1916, is extended by one day.

No. 38.—On return from the privilege leave granted him in this office Orders Nos. 7, 24 and 37, dated respectively, the 24th January 1916, 8th March 1916 and 11th May 1916, Mr. E. Hore, Extra Assistant Conservator of Forests, was attached to the Balaghat Division from the 29th March to the 4th April 1916, and was then transferred to the Bihar Range of which he took charge on the 5th April 1916.

18th May 1916.—No. 1074.—Leave on private affairs for three months, under Articles 232, 233 (iii), 260 and 337 of the Civil Service Regulations, is granted to Mr. A. Hunt, Extra Assistant Conservator of Forests, in charge of the Seoni Forest Division, in extension of the combined leave granted him by Order No. 2110, dated the 7th October 1915.

20th May 1916.—No. 39.—Privilege leave for three weeks is granted, under Article 260 of the Civil Service Regulations, to Mr. B. D. Ukidwe, Extra Assistant Conservator of Forests, attached to the Betul Division, with effect from the 2nd June 1916, or any subsequent date from which he is permitted to avail himself of it.

8.—MADRAS GAZETTE.

28th April 1916.—No. 180.—Mr. N. E. Shrigley, Probationary Extra Assistant Conservator of Forests, Bombay Presidency, is appointed on a year's probation as Special Forest Officer on Rs. 350—50—700 for the Golconda Agency and Hill Madgole in the Vizagapatam District.

No. 185.—The following postings of Forest Officers are ordered to take effect from 1st May 1916 :—

(1) Mr. John Hemsley Longrigg, Assistant Conservator of Forests, to be District Forest Officer, Mangalore South.

(2) Mr. Jambunatha Ayyar Sadasiva Ayyar, Extra Assistant Conservator of Forests, to be District Forest Officer, Mangalore North.

3rd May 1916.—No. 197.—The Secretary of State has been pleased to sanction an extension of fourteen days' furlough on medical certificate to Mr. J. S. Scot, Deputy Conservator of Forests.

6th May 1916.—No. 202.—The following posting of a Forest Officer is ordered :—

M. R. Ry. Vallore Raman Menon Avargal, Extra Deputy Conservator of Forests, to be District Forest Officer, Trichinopoly. To join forthwith.

10th May 1916.—No. 209.—M. R. Ry. A. Raju Nayakar Avargal, Extra Assistant Conservator of Forests, is granted privilege leave for two months from or after the 15th May 1916.

12th May 1916.—No. 211.—The following posting of a Forest Officer is ordered :—

M. R. Ry. E. V. Padmanabha Pillai Avargal, Extra Assistant Conservator of Forests, on probation, to be District Forest Officer, Cuddapah West, during the absence of M. R. Ry. A. Raju Nayakar Avargal on leave or until further orders.

13th May 1916.—No. 210.—Under Articles 233, 260 and 336 of the Civil Service Regulations, M. R. Ry. Rao Sahib M. Rama Rao Avargal, Extra Deputy Conservator of Forests, is granted combined privilege leave and leave on medical certificate for one year.

15th May 1916.—Under Article 260, Civil Service Regulations, the Board grants privilege leave for one month to Mr. D. L. Sathe, District Forest Officer, Chittoor, from or after 26th May 1916.

2. M. R. Ry. S. V. Devadasan, Extra Assistant Conservator of Forests, will be in charge during Mr. Sathe's absence on leave.

18th May 1916.—No. 225.—The following posting of a Forest Officer is ordered :—

Mr. James Stewart Scot, Deputy Conservator of Forests, to be District Forest Officer, North Salem, on return from leave.

9.—BOMBAY GAZETTE.

20th April 1916.—No. 4339.—His Excellency the Governor in Council is pleased to appoint Mr. W. E. Copleston to hold charge of the office of the Divisional Forest Officer, Central Thana, in addition to his own duties, during the absence on leave of Mr. Bhagwandas Harkisandas Dalal or pending further orders.

No. 4344.—Mr. J. B. T. Brooks, Divisional Forest Officer, West Khandesh, is granted privilege leave for three months in combination with special leave on urgent private affairs for three months with effect from 24th April 1916 or the subsequent date on which he may be relieved.

No. 4345.—His Excellency the Governor in Council is pleased to appoint Mr. A. F. Gonsalves to act as Divisional Forest Officer, West Khandesh, *vice* Mr. J. B. T. Brooks proceeding on leave, pending further orders.

26th April 1916.—No. 119.—Mr. B. H. Dalal, Extra Deputy Conservator of Forests, delivered over and Mr. W. E. Copleston received charge of the office of the Divisional Forest Officer, Central Thana, on the 20th April 1916, in the afternoon.

29th April 1916.—No. Camp-37.—Mr. A. F. Gonsalves, Extra Assistant Conservator of Forests, relinquished charge of his duties as Personal Assistant to the Conservator of Forests, Central Circle, Bombay, and received charge of the office of the Divisional Forest Officer, West Khandesh, from Mr. J. B. Brooks, Assistant Conservator of Forests, on the 24th April 1916, in the afternoon.

2nd May 1916.—No. 4606.—Mr. A. C. Hiley, Divisional Forest Officer, Kanara, Western Division, is granted privilege leave for three months in combination with special leave on urgent affairs.

No. 4607.—His Excellency the Governor in Council is pleased to make the following appointments, *vice* Mr. A. C. Hiley, proceeding on leave :—

Mr. G. E. Marjoribanks to be Divisional Forest Officer, Western Division, Kanara.

Mr. R. W. Inder to be Divisional Forest Officer, Surat, and *ex officio* Assistant Political Agent for the Dangas.

Mr. P. E. Aitchison to hold charge of the office of the Working-Plans Officer, Northern Circle, in addition to his own duties.

10th May 1916.—No. 553.—Mr. G. R. Duxbury, Deputy Conservator of Forests, delivered over charge of the Dharwar-Bijapur Forest Division to Mr. T. N. Koppikar, Extra Assistant Conservator of Forests, on the afternoon of the 8th April 1916.

15th May 1916.—No. 215.—Mr. G. E. Marjoribanks, Deputy Conservator of Forests, delivered over and Mr. R. W. Inder, Deputy Conservator of Forests, received charge of the office of the Divisional Forest Officer, Surat, on the afternoon of the 4th instant.

18th May 1916.—No. C.-148.—Mr. G. R. Patkar, Extra Assistant Conservator of Forests, relinquished charge of his duties as Range Forest Officer, Haveli, on the afternoon of the 1st May 1916 and received charge of the office of the Sub-divisional Forest Officer, North Khandesh, from Mr. B. J. Joshi, Extra Assistant Conservator of Forests, on the 11th May 1916, in the forenoon.

20th May 1916.—No. 246.—Mr. R. W. Inder, Deputy Conservator of Forests, delivered over and Mr. P. E. Aitchison, Deputy Conservator of Forests, received charge of the office of the Divisional Forest Officer, Working-plans, N.C., on the 4th May 1916, in the afternoon.

10.—BURMA GAZETTE.

10th April 1916.—No. 55.—The Lieutenant-Governor appoints Mr. R. Unwin, Assistant Conservator of Forests, attached to the Pyinmana Forest Division, to succeed Mr. C. G. E. Dawkins, now Divisional Forest Officer, Bassein-Myaungmya Forest Division, as the Forest Officer who shall assist the Forest Settlement Officer in the enquiry ordered in Revenue (Forest) Department Notification No. 222 of the 27th November 1915, regarding the proposed Mehaw Extension Reserve in the Yamethin District.

11th April 1916.—No. 56.—Under the provisions of Article 260 of the Civil Service Regulations, privilege leave for one month is granted to Mr. J. W. Bradley, Deputy Conservator of Forests, attached to the Prome Division, with effect from 10th April 1916, or the subsequent date on which he may avail himself of it.

No. 57.—Under the provisions of Article 260 of the Civil Service Regulations, privilege leave for one month is granted to Mr. G. C. Cheyne, Assistant Conservator of Forests, attached to the Zigôn Division, with effect from 10th April 1916, or the subsequent date on which he may avail himself of it.

18th April 1916.—No. 8.—With reference to Revenue (Forest) Department Notification No. 53, dated 5th April 1916, Mr. F. E. C. Palmer, Extra Assistant Conservator of Forests (on return from leave) reported himself for duty in the Katha Division on the forenoon of the 1st April 1916.

20th April 1916.—No. 59.—On completion of the special duty in the Bassein-Myaungmya Forest Division to which he was posted in this Department Notification No. 24 of the 4th March 1916, Mr. A. Lawrence, Deputy Conservator of Forests, is reposted to the charge of the Bassein-Myaungmya Forest Division, in place of Mr. C. G. E. Dawkins, Deputy Conservator of Forests, transferred.

No. 60.—On relief by Mr. A. Lawrence, Deputy Conservator of Forests, Mr. C. G. E. Dawkins, Deputy Conservator of Forests, is transferred from Bassein and appointed First Instructor, Burma Forest School, Pyinmana.

28th April 1916.—No. 14.—With reference to Revenue (Forest) Department Notification No. 57, dated the 11th April 1916, Mr. G. C. Cheyne, Assistant Conservator of Forests, availed himself of the one month's privilege leave granted to him with effect from the afternoon of the 18th April 1916.

1st May 1916.—No. 62.—Under the provisions of Article 260 of the Civil Service Regulations, privilege leave for six weeks is granted to Mr. C. H. Philipp, Deputy Conservator of Forests, in charge of the Zigôn Forest Division, with effect from the 15th April 1916 or the subsequent date on which he may avail himself of it.

No. 63.—Mr. B. P. Kelly, Extra Deputy Conservator of Forests, on duty in the Zigôn Forest Division, is placed in charge of that Division as a temporary measure in place of Mr. C. H. Philipp, Deputy Conservator of Forests, proceeding on leave,

4th May 1916.—No. 64.—On return from leave, Mr. D. A. Allan, Extra Assistant Conservator of Forests, is reposted to duty in the Thayetmyo Forest Division.

No. 65.—Mr. D. H. M. Silvanus, Deputy Conservator of Forests, attached to the South Toungoo Forest Division, is transferred from Toungoo and is posted to duty in the West Salween Forest Division with head-quarter sat Papun.

5th May 1916.—No. 66.—On return from leave, Mr. J. W. Bradley, Deputy Conservator of Forests, is reposted to duty in the Prome Forest Division.

No. 67.—On return from leave, Mr. G. C. Cheyne, Assistant Conservator of Forests, is reposted to duty in the Zigôn Forest Division.

6th May 1916.—No. 68.—Under the provisions of Article 260 of the Civil Service Regulations, privilege leave for three months is granted to Mr. G. F. Matthews, Extra Assistant Conservator of Forests, in charge of the Shwegu Sub-division, Bhamo Forest Division, with effect from the 5th June 1916, or the subsequent date on which he may avail himself of it.

No. 69.—Mr. A. R. Villar, Deputy Conservator of Forests, attached to the Bhamo Forest Division, is transferred from Bhamo and is posted to the charge of the Shwegu Sub-division, Bhamo Forest Division, in place of Mr. G. F. Matthews, Extra Assistant Conservator of Forests, proceeding on leave.

9th May 1916.—No. 15.—With reference to Revenue (Forest) Department Notifications Nos. 62 and 63, dated the 1st May 1916, Mr. C. H. Philipp, Deputy Conservator of Forests, made over, and Mr. B. P. Kelly, Extra Deputy Conservator of Forests, received, charge of the Zigôn Forest Division on the afternoon of the 17th April 1916. Mr. Philipp availed himself of the six weeks' privilege leave granted to him from the forenoon of the following date.

11th May 1916.—No. 2.—With reference to Revenue (Forest) Department Notification No. 60, dated the 20th April 1916, Mr. C. G. E. Dawkins, Deputy Conservator of Forests, assumed charge of his duties as First Instructor, Burma Forest School, Pyinmana, on the forenoon of the 2nd May 1916.

TIMBER AND PRODUCE RATES.

C. LEARY & CO.'S LONDON MARKET REPORT.

1st to 29th April 1916.

EAST INDIA TEAK. — *Timber*.—The demand is very restricted and sales are difficult to effect.—*Planks*.—Although values continue firm there is little business to report. Quotations are : Timber, £16 to £30 (Java, £12 to £22); Flitches, £20 to £30 (Hewn Java £15 to £23); Planks, £17 to £30 (Java, £15 to £22); all at per load on c.i.f. terms. The analysis of deliveries and stocks is as follows :—

Deliveries for April.		Deliveries to 29th April.		Dock Stock.	
Loads.		Loads.		Loads.	
<i>Timber.</i>	<i>Planks.</i>	<i>Timber.</i>	<i>Planks.</i>	<i>Timber.</i>	<i>Planks.</i>
1916 ... 263	291	696	890	1,463	4,115
1915 ... 175	163	1,942	791	1,971	3,680
1914 ... 196	427	983	1,410	2,421	2,777

PADOUK.—The prohibition of the import of this wood has been removed. Supplies are much wanted.

*SATINWOOD.—East India.—The demand is restricted.

*ROSEWOOD.—East India.—The tone is dull and there is a sufficient stock.

*EBONY.—Ceylon and East India.—There is practically no stock, but the demand is very restricted.

*The import of these woods is prohibited except under license.

QUOTATIONS FOR FOREST PRODUCTS.

Name of Products.	Market for which quoted.	Latest prices received.	Per	Average rates for period from April to June 1916.	Per	REMARKS.
Agar Wood	London ...	Rs. 40 to Rs. 68	md.	Rs. 41-5-4 to Rs. 68	md.	According to grades.
Bees-wax	Calcutta ...	††£6 to £6 10s.	cwt.	**£6 to £6 10s.	cwt.	
E. I. yellow	London ...	††£8 to £10	ton	Not available.		
Boxwood	" "	††£8 to £10	lb.	*1s. 7d. to 5s. 7d.	lb.	
Cardamoms	" "	††£8 to £10	cwt.	*42s. 6d. to 47s. 6d.	cwt.	"
Croton Seed	Rangoon ...	Rs. 50 to Rs. 65	"	Rs. 49-5-4 to Rs. 63-5-4	"	
Cutch (Tablet)	" "	Rs. 57 to Rs. 60	"	Rs. 56-5-4 to Rs. 60-2-8	"	
(Block)	" "	Rs. 45 to Rs. 50	"	Rs. 46 to Rs. 48-5-4	"	
(Basket)	London ...	Not available.				"
" "	" "	"				
Ebony	" "	"				
" "	" "	"				
Elephant Tusks—						
50 lbs. and upwards	London ...	††£65 to £71 10s.	cwt.	**£65 to £70 10s.	cwt.	
Fibres and Flosses—						
Coir	Calcutta ...	Rs. 5 to Rs. 5-12	md.	Rs. 4-14-8 to Rs. 5-13-4	md.	In bales of 200 lbs.
Kapok (Floss)	" "	Rs. 18 to Rs. 20-4	"	Rs. 18-3-4 to Rs. 19-4	"	
(Fibre)	London ...	††10d. to 11d.	lb.	Not available.		
Kitool	" "	††1d. to 11d.	ton	"	ton	
Palmira	" "	£25 to £39		*£27 to £44 6s. 10d.		"
Rhea or China grass	" "	††£42 to £47		Not available.		
Gum Arabic	Bombay ...	Re. 1	lb.	"	cwt.	
Karachi	London ...	†22s. 6d. to 32s. 6d.	cwt.	*22s. 6d. to 32s. 6d.	cwt.	
Madras	" "	†20s. to 30s.	"	*20s. to 30s.	"	"
Kino	Bombay ...	Re. 1-8	lb.	Not available.		
" "	London ...	Not quoted.				
Catechu	Bombay ...	Re. 1	lb.	"		

Name of Products.	Market for which quoted.	Latest prices received.	Per	Average rates for period from April to June 1916.	Per	REMARKS.
Rosin, "F" grade	Bombay ...	Rs. 13-12-10 to Rs. 14-4-5	md.	Rs. 13-15-11 to Rs. 14-14-2	md.	(barrel of 4 to 5 cwts.)
" " "G" grade	Calcutta ...	Rs. 90 to Rs. 96	per barrel			
" " Common strained	London ...	†Rs. 11-8-6	md.	*Rs. 11-9-11 to Rs. 11-11-5	md.	
" " "G" grade	Calcutta ...	Rs. 14-10-3 to Rs. 14-13-2	"	Rs. 14-6-4 to Rs. 15-1-1	"	
" " "G" "	London ...	Rs. 11-15 to Rs. 11-12-9	"	Rs. 11-15 to Rs. 11-15-9	"	
" " "H" "	"	†Rs. 12-1-3	"	*Rs. 12-1-3 to Rs. 12-2-9	"	
" " "H" "	Calcutta ...	Rs. 20 to Rs. 60	"	Rs. 20 to Rs. 60	"	
Rubber, India						
" Assam	London ...	†2s.	lb.	*2s. 1½d.	lb.	
" Burma	"	†2s.	"	*2s. 1d.	"	
" Para	"	†2s. 10d.	"	*2s. 3½d. to 3s. 1½d.	"	
Senna (Tinnevely)	"	†8d. to 1s.	lb.	*8½d. to 11½d.	lb.	
Shellac, T.N. in Diamond	Calcutta ...	Rs. 42 to Rs. 48	md.	Rs. 40-1-4 to Rs. 47	md.	
" T.N. "	London ...	†93s.	cwt.	Not available.		
" T.N. in Orange	"	†90s. to 130s.	"	*95s. to 130s.	cwt.	
" A.C. in Garnet...	"	†85s. to 90s.	"	*83s. 4d. to 86s. 8d.	"	
" A.C.	Calcutta ...	Rs. 39 to Rs. 40	md.	Rs. 38-10-8 to Rs. 39-5-4	md.	
Sleepers, Chir—						
" 12'	Jagadhari	Rs. 59 to Rs. 62	score	Rs. 58-5-4 to Rs. 62-2-8	score	
" 11'	"	Rs. 48 to Rs. 51	"	Rs. 41-5-4 to Rs. 51-8	"	
" 8'	"	Rs. 33 to Rs. 36	"	Rs. 32-10-8 to Rs. 36	"	
" 6'	"	Rs. 20 to Rs. 23	"	Rs. 20-5-4 to Rs. 24-5-4	"	
Scantlings 11'	"	Rs. 21 to Rs. 22-8	"	Rs. 20-5-4 to Rs. 23-10-8	"	
Tamarinds—						
Madras	London ...	Not quoted.				
Calcutta	"	†25s. to 26s.	cwt.	*25s. to 26s. 4d.	cwt.	
Indian	Calcutta ...	Re. 1-14 to Rs. 4	md.	Re. 1-12-8 to Rs. 4-8	md.	According to quality and quantity.
Teak (selected Indian, 1st class)	"	Rs. 150 to Rs. 155	ton	Rs. 142-10-8 to Rs. 156-10-8	ton	Ton = 50 c. ft.

Turpentine—		London ...		†Rs. 2-8 to Rs. 2-9		gal.		*Rs. 2-10-10 to Rs. 2-13		gal.	
“ American Spirit Spot	...	Calcutta	...	} No stock.	}	gal.				gal.	
“ Weight Brand	...	“	...								
“ Hand	...	“	...								
“ Substitute	...	“	...								
“ Hubbuck's Genuine	...	“	...								
“ Blundell & Spence	...	Bombay	...	Rs. 4-2 to Rs. 5		“	Re. 1-11 to Rs. 2-1-4	Rs. 4-8-8 to Rs. 5-0-8	“	“	
“ Wilkinson Heywood & Clerk	...	“	...	Rs. 4-11-2 to Rs. 4-14-5		“	Rs. 4-11-6 to Rs. 4-13-11	Rs. 4-11-6 to Rs. 4-13-11	“	“	
“ Standard Oil Co	...	“	...	Rs. 4-5-7 to Rs. 4-8-10		“	Rs. 4-6-11 to Rs. 4-9-7	Rs. 4-6-11 to Rs. 4-9-7	“	“	
		“	...	No stock.							
		“	...								
		“	...								

NOTE.—† Represents rates for May 1916.

* Represents average rates for the period from March to May 1916.

†† Represents average rates for April 1916.

** Represents average rates for the period from February to April 1916.

Md. Indicates Bengal Maund which is equal to 82 lbs.

All prices shown in column No. 3 represent the highest and lowest prices recorded up to the 27th June 1916.

All prices shown in column No. 5 represent the average rates for three months' prices, recorded up to the 27th June 1916.

All prices, not cross-marked in the third column, are the market rates for June 1916.

DEHRA DUN, U. P. : }
Dated 1st July 1916.

(Sd.) R. S. PEARSON,
Forest Economist.

LIST OF BOOKS AND PUBLICATIONS RECEIVED
BY THE HONORARY EDITOR DURING
THE MONTH OF MAY 1916.

- Indian Engineering, Vol. LIX, Nos. 19, 20, 21 and 22 for 6th, 13th, 20th and 27th May 1916.
 Tropical Agriculturist, Vol. XLVI, No. 4 of April 1916.
 Forest Protection in Canada, 1913-14—Commission of Conservation, Canada.
 Review of Forest Administration Report of the Jammu and Kashmir State for 1912-13 (S. 1969).
 The Forest Flora of New South Wales, Vol. VI, Part 7 of 1915, and Vol. VI, Part 8 of 1916.
 Denny, Mott and Dickson, Limited, Wood Market Report, London, 3rd April 1916.
 Government of Madras, Revenue Department, G. O. No. 298, 10th February 1916—On the Introduction of the Forest Village System into the Madras Presidency.
 The Review of Applied Entomology, Series A: Agricultural, Vol. IV, Part 3 of March 1916
 The Review of Applied Entomology, Series B: Medical and Veterinary, Vol. IV, Part 3 of March 1916.
 The Scottish Geographical Magazine, Vol. XXXII, No. 4 for April 1916.
 Classified List of Forest Officers of Imperial and Provincial Services in India and Burma on 1st January 1916.
 Report on the Administration of the Travancore Forest Department for M.E. 1090.
 Indian Rubber World, Vol. LIV, No. 1 for 1st April 1916.
 Experiment Station Record, Vol. XXXIV, No. 4 of March 1916.
 The Indiaman, No. 101, Vol. IV, dated 14th April 1916.
 A Note on the Milk Supply of Bangalore—Department of Agriculture, Mysore State, General Series, Bulletin No. 7 of 1916.
 Journal of the Board of Agriculture, Vol. XXIII, No. 1 of April 1916
 Report on the Forest Administration in Burma for the year 1914-15.
 The Gases of Swamp Rice Soils, Part III (A Hydrogen-Oxidizing Bacterium from these Soils)—Memoirs of the Department of Agriculture, Vol. IV, No. 4 for April 1916.
 Some Factors affecting the Cooking of Dhall (*Cajanus indicus*)—Memoirs of the Department of Agriculture, Vol. IV, No. 5 of April 1916.
 Memorandum by General Sir Reginald Wingate on the Finances, Administration and Condition of the Sudan, 1914
 Annual Report on the Forest Administration in Ajmer-Merwara for the year 1914-15.
 Bulletin Economique De L'Indochine, No. 116 for November-December 1915.
 Report on the Progress of Agriculture in India for 1914-15.
 American Forestry, Vol. 22, No. 268 for April 1916.
 Gwalior Forest Trees and their Economic Uses (in Hindi).
 Studies in Indian Oil Seeds, No. I, Safflower and Mustard—Agricultural Research Institute, Pusa, Botanical Series, Vol. VII, No. 7 for December 1915.

GAZETTE NOTIFICATIONS.

1.—GAZETTE OF INDIA.

10th July 1916.—No. 419-F.-67-12.—Mr. P. H. Clutterbuck, Chief Conservator of Forests, United Provinces, is granted furlough for three months in extension of his present privilege leave (*vide* this Department Notification No. 200-F.-67-6, dated the 12th April 1916.)

Mr. H. G. Billson, *Provisional Substantive* Conservator of Forests, 3rd grade, Western Circle, United Provinces, is appointed to officiate as Chief Conservator of Forests, United Provinces, with effect from the 1st June 1916

Mr. R. M. Williamson, officiating Conservator of Forests, 3rd grade, Eastern Circle, United Provinces, is appointed to be *Provisional Substantive* Conservator, 3rd grade, with effect from the 1st June 1916, *vice* Mr. H. G. Billson.

Mr. F. F. R. Channer, Deputy Conservator of Forests, United Provinces, is appointed to officiate as Conservator of Forests, 3rd grade, in charge of the Western Circle, United Provinces, with effect from the date from which he takes over charge of that Circle.

28th July 1916.—No. 464-F.-315-6.—Mr. R. C. Milward, Deputy Conservator of Forests, United Provinces, on reversion from the Indian Army Reserve of Officers, is appointed to officiate as Conservator of Forests, 3rd grade, in charge of the Tenasserim Circle, Burma, with effect from the 5th July 1916, forenoon.

From the same date Mr. H. S. Ker-Edie, officiating Conservator, 3rd grade, reverted to the class of Deputy Conservators.

2.—BENGAL GAZETTE.

7th July 1916.—No. 12-For.—Babu Mohim Chandra Chaudhuri, Extra Assistant Conservator of Forests, is granted privilege leave for two months and two days, under Article 260 of the Civil Service Regulations, with effect from the 1st August 1916, or such later date as he may avail himself of the leave. He is also permitted to affix the Durga Puja holidays to the leave under Article 220 of the Civil Service Regulations.

3.—BIHAR AND ORISSA GAZETTE.

15th July 1916.—No. $\frac{5417}{III F-85}$ —R.—Munshi Bikram Hansdah, Forest Ranger, is appointed to be a Probationary Extra Assistant Conservator of Forests in Bihar and Orissa, with effect from the 1st July 1916.

4.—ASSAM GAZETTE.

4th July 1916.—No. 2263R.—Mr. L. J. Delanougerede, Extra Assistant Conservator of Forests, is attached to the Direction Division, Western Circle, as a temporary measure.

7th July 1916.—No. 2319R.—Mr. G. R. Edwards, Assistant Conservator of Forests, is granted combined leave for seven months and twelve days, *viz.*, privilege leave for fourteen days and furlough on medical certificate for the remaining period, under Articles 260, 233, and 311 (b) of the Civil Service Regulations, with effect from the 20th May 1916.

2. This cancels this Department Notification No. 1977R., dated the 13th June 1916.

8th July 1916.—No. 2334R.—Mr. W. Meiklejohn, Assistant Conservator of Forests, is attached to the Kamrup Forest Division,

5. — UNITED PROVINCES GAZETTE.

23rd June 1916.—No. 30.—In Notification No. 25, dated the 7th June 1916, posting Mr. G. K. Murphy, Extra Assistant Conservator of Forests, to the Direction Division, Eastern Circle, for the words "on return from one month's privilege leave" read "on return from one month and nine days' privilege leave."

24th June 1916.—No. 31.—On return from privilege leave, Mr. E. Benskin, Deputy Conservator of Forests, is posted to the charge of the Afforestation and Etawah Divisions in the Eastern Circle.

No. 32.—Consequent on the return of Mr. E. Benskin, Deputy Conservator of Forests, from privilege leave, the following reversions to take place :—

Mr. H. W. Moor, Extra Assistant Conservator of Forests, in charge of the Afforestation Division, Eastern Circle, to revert as attached Officer in the same Division.

Lala Girdhari Lal, Extra Assistant Conservator of Forests, in charge of the Etawah Forest Division, Eastern Circle, to revert as attached Officer in the same Division.

8th July 1916.—No. 32.—Mr. D. Barrow, Extra Assistant Conservator of Forests, attached to North Kheri Division, Eastern Circle, privilege leave for two months and twenty-five days, with effect from the 15th July 1916.

14th July 1916.—No. 33.—Babu Sirtaj Bahadur, Extra Assistant Conservator of Forests, attached to Haldwani Division, Western Circle, is granted one month's privilege leave, with effect from the date he avails himself of it.

19th July 1916.—No. 34.—Mr. S. H. Howard, Assistant Conservator of Forests, is posted to the charge of the Siwalik Forest Division, Western Circle, Dehra Dun, with effect from the 10th July 1916, in addition to his duties as Officer in charge of the Ramnagar Working Plans, Western Circle.

6.—PUNJAB GAZETTE.

29th June 1916.—No. 240.—*Erratum.*—*Punjab Government Gazette* Notification No. 190, dated 19th May 1916, regarding the posting of Mr. L. B. Holland, Deputy Conservator of Forests, to the Bashahr Division, for the words "22 idem" read "22 April 1916."

8th July 1916.—No. 248.—Bhai Kartar Singh, Extra Assistant Conservator of Forests, attached to the Resin Forest Division, is granted three months' privilege leave with effect from the 16th June 1916.

7.—CENTRAL PROVINCES GAZETTE.

27th June 1916.—No. 1390.—Order No. 1218, dated the 8th June 1916, appointing Mr. Balkrishna Dinkar Ukidwe, Extra Assistant Conservator of Forests, to the charge of the North Mandla Forest Division and to hold charge of the South Mandla Forest Division, in addition to his own duties, is hereby cancelled.

No. 1391.—Order No. 1219, dated the 8th June 1916, transferring Mr. C. M. Harlow, Assistant Conservator of Forests, to the charge of the Chhindwara Forest Division, is hereby cancelled.

3rd July 1916.—No. 54.—On return from the combined leave for six months granted to him in this office Order No. 32, dated the 11th April 1916, Mr. Nazir Abbas, Extra Assistant Conservator of Forests, is posted to the Nimar Forest Division as an attached Officer.

11th July 1916.—No. 1489.—Mr. H. S. George, Assistant Conservator of Forests, attached to the Hoshangabad Forest Division, is transferred to the Conservator's office, Northern Circle.

15th July 1916.—No. 1512.—On relief by Mr. C. F. Bell, Deputy Conservator of Forests, on return from privilege leave, Mr. Chintaman Vishwanath Sarwate, Extra Assistant Conservator of Forests, is appointed to the charge of the Saugor Forest Division.

Order No. 1148, dated the 30th May 1916, is hereby cancelled.

No. 1513.—On relief by Mr. Chintaman Vishwanath Sarwate, Mr. C. A. Von B. Malcolm, Deputy Conservator of Forests, is placed on special duty in connection with the compilation of the Yeotmal Working Plan.

18th July 1916.—No. 57.—Privilege leave for two months, under Article 242 (a) of the Civil Service Regulations, is granted to Mr. D. C. McDonald, Extra Assistant Conservator of Forests, sub. *pro tem.*, attached to the Honshangabad Forest Division, with effect from the 20th July 1916, or any subsequent date from which he may be allowed to avail himself of it.

No. 1531.—On return from the combined leave granted him by Orders No. 2110, dated the 7th October 1915, and No. 1074, dated the 18th May 1916, Mr. A. Hunt, Extra Deputy Conservator of Forests, is posted to the charge of the Bilaspur Forest Division.

No. 1532.—On relief by Mr. Hunt of the charge of the Bilaspur Forest Division, Mr. Vinayak Chimnaji Bhagwat, Extra Assistant Conservator of Forests, is transferred to the Nagpur-Wardha Forest Division as an attached Officer.

19th July 1916.—No. 1541.—On return from the leave granted him by Order No. 766, dated the 18th April 1916, Mr. R. H. Cole, Extra Assistant Conservator of Forests, is posted to the charge of the North Mandla Forest Division.

No. 1542.—On relief by Mr. Cole of the charge of the North Mandla Forest Division, Mr. Balkrishna Dinkar Ukidwe, Extra Assistant Conservator of Forests, is transferred to the Betul Division as an attached Officer.

8.—MADRAS GAZETTE.

23rd June 1916.—Mr. R. Bourne, District Forest Officer, South Malabar, is granted privilege leave for three weeks from the 1st July 1916.

2. Mr. W. C. Hart, Extra Assistant Conservator, on probation, to be in charge of South Malabar during the period.

26th June 1916.—The following postings of Forest Officers are ordered by the Board :—

Mr. C. C. Wilson, Working Plans Officer, Southern Circle, to the Western Circle, as Working Plans Officer, with Coimbatore as head-quarters.

M. R. Ry. M. R. Sundaram Ayyar, Probationary Extra Assistant Conservator of Forests, from the Southern to the Western Circle, to work under the Special Working Plans Officer.

29th June 1916.—No. 297.—The Secretary of State has been pleased to grant to Mr. J. S. Scot, Deputy Conservator of Forests, an extension of furlough on medical certificate for one month and nine days from 26th May 1916.

1st July 1916.—Mr. M. C. Chandy, B.Sc., Probationary Extra Assistant Conservator of Forests, South Coimbatore, is transferred to Mangalore North, for charge of the Coondapur range. To join on completion of the Departmental Examinations.

3rd July 1916.—No. 317.—The following promotion of a Forest Officer is ordered :—

Mr. Francis Loftus Cowley Cowley-Brown, Conservator of Forests, 3rd grade, on probation, to act as Conservator of Forests, 2nd grade, with effect from 13th July 1916, during the furlough portion of the leave granted to Mr. McCarthy.

10th July 1916.—No. 325.—Under Article 260 of the Civil Service Regulations, Mr. A. B. Myers, District Forest Officer, North Malabar, is granted three months' privilege leave with effect from the date of Mr. Bourne's return from leave.

11th July 1916.—No. 329.—The following posting of a Forest Officer is ordered :—

Mr. Ray Bourne, District Forest Officer, South Malabar, to be in charge of North Malabar in addition to his present duties during the absence of Mr. A. B. Myers on privilege leave.

9.—BOMBAY GAZETTE.

26th June 1916.—No. 629.—Mr. B. J. Patel, Extra Assistant Conservator of Forests, attached to the Divisional Forest Office, Surat, to study the system of record employed in the Collector's office, delivered over charge of the office of the Sub-divisional Forest Officer, Panch Mahals, to Mr. W. C. Milne, Divisional Forest Officer, on the 16th June 1916, in the afternoon.

18th July 1916.—No. 1408.—Mr. R. Haines, Executive Engineer, who was on special work in the Forest Department, relinquished charge of the same on the 11th July 1916 in the afternoon on reversion to the Public Works Department.

24th July 1916.—No. 882.—Mr. B. J. Patel, Extra Assistant Conservator of Forests, assumed charge of his duties in connection with the study of Mr. Anderson's System of Record on the 19th June 1916 in the forenoon.

No. 7307.—His Excellency the Governor in Council is pleased to appoint Mr. Ramchandra Krishna Kanitkar to act as Divisional Forest Officer, Surat, *vice* Mr. R. W. Inder proceeding on military duty, pending further orders.

25th July 1916.—No. 7315.—His Excellency the Governor in Council is pleased to make the following appointments:—

Mr. W. F. D. Fisher to hold charge of the office of Divisional Forest Officer, South Nasik, in addition to his own duties, *vice* Mr. D. R. S. Bourke proceeding on military duty, pending further orders.

Mr. Bajibhai Jadhavbhai Patel to act as Divisional Forest Officer, Panch Maháls, *vice* Mr. W. C. Milne proceeding on military duty, pending further orders.

Mr. Ramchandra Vaman Pethe to act as Divisional Forest Officer, East Khandesh, *vice* Mr. R. P. Dalley proceeding on military duty, pending further orders.

10.—BURMA GAZETTE.

12th June 1916.—No. 8.—With reference to Revenue (Forest) Department Notification No. 94, dated the 7th June 1916, Mr. D. J. Munro, Extra Assistant Conservator of Forests, relinquished charge of his duties in the Yaw Forest Division on the afternoon of the 2nd June 1916.

13th June 1916.—No. 9.—With reference to Revenue (Forest) Department Notification No. 69, dated the 6th May 1916, Mr. G. F. Matthews, Extra Assistant Conservator of Forests, made over, and Mr. A. R. Villar, Deputy Conservator of Forests, on duty in the Bhamo Forest Division, received charge of the Shwegu Sub-division on the forenoon of the 3rd June 1916.

From the same date Mr. G. F. Matthews availed himself of the leave granted him in Revenue (Forest) Department Notification No. 68, dated the 6th May 1916.

17th June 1916.—No. 11.—With reference to Revenue (Forest) Department Notification No. 89, dated the 6th June 1916, Mr. W. S. Powell, Deputy Conservator of Forests, made over, and Mr. R. L. Pocock, Extra Deputy Conservator of Forests, received, in addition to his own duties, charge of the Thaungyin Forest Division on the afternoon of the 29th May 1916.

On the same date Mr. W. S. Powell, Deputy Conservator of Forests, availed himself of the leave granted him in Revenue (Forest) Department Notification No. 88, dated the 6th June 1916.

21st June 1916.—No. 12.—With reference to Revenue (Forest) Department Notification No. 93, dated the 7th June 1916, Mr. J. M. Campbell, Probationary Extra Assistant Conservator of Forests, relinquished his duties in the Pegu Forest Division on the afternoon of the 14th June 1916.

No. 13.—With reference to Revenue (Forest) Department Notification No. 94, dated the 7th June 1916, Mr. D. J. Munro, Extra Assistant Conservator of Forests, reported his arrival in the Pegu Forest Division on the forenoon of the 9th June 1916 and assumed charge of his duties on the afternoon of the 14th.

No. 14.—With reference to Revenue (Forest) Department Notification No. 83, dated the 22nd May 1916, Mr. P. Burnside, Extra Assistant Conservator of Forests, received charge of the Revenue Range, South Toungoo Forest Division, from Mr. E. B. Powell, Extra Assistant Conservator of Forests, on the afternoon of the 12th June 1916.

On the same date Mr. E. B. Powell, Extra Assistant Conservator of Forests, availed himself of the leave granted him in Revenue (Forest) Department Notification No. 82, dated the 22nd May 1916.

22nd June 1916.—No. 9.—With reference to Revenue (Forest) Department Notification No. 93, dated the 7th June 1916, Mr. J. M. Campbell, Probationary Extra Assistant Conservator of Forests, assumed charge of his duties in the Yaw Forest Division on the forenoon of 21st June 1916.

23rd June 1916.—No. 15.—With reference to Revenue (Forest) Department Notification No. 86, dated the 2nd June 1916, Maung San E., Extra Assistant Conservator of Forests, West Salween Forest Division, Moulmein, availed himself of the three months' privilege leave with effect from the forenoon of the 1st June 1916.

26th June 1916.—No. 10.—With reference to Revenue (Forest) Department Notifications Nos. 90 and 91, dated the 7th June 1916, Mr. J. L. Hefferman, Extra Deputy Conservator of Forests, made over, and Mr. F. P. Thomson, Extra Assistant Conservator of Forests, received charge of the Bampon Forest Sub-division of the Southern Shan States Forest Division on the afternoon of the 19th June 1916.

29th June 1916.—No. 21.—With reference to Revenue (Forest) Department Notification No. 80, dated the 18th May 1916, Mr. E. H. Peacock, Probationary Extra Assistant Conservator of Forests, relinquished charge of his duties in the Henzada-Ma-ubin Forest Division on the afternoon of the 6th June 1916 and assumed charge of his duties in the Zigôn Forest Division on the forenoon of the 8th June 1916, with head-quarters at Zigôn.

No. 112.—Mr. G. S. Shirley, Deputy Conservator of Forests, attached to the Katha Forest Division, is transferred from Katha and attached to the Mandalay Forest Division, as a temporary measure.

No. 119.—Under the provisions of Article 260 of the Civil Service Regulations, privilege leave for three months is granted to Mr. D. J. Munro, Extra Assistant Conservator of Forests, attached to the Pegu Forest Division, with effect from the date on which he may avail himself of it.

No. 120.—Mr. W. C. Rooke, Probationary Extra Assistant Conservator of Forests, attached to the North Toungoo Forest Division, is transferred from Toungoo and is attached to the Pegu Forest Division, in place of Mr. D. J. Munro, Extra Assistant Conservator of Forests, proceeding on leave.

3rd July 1916.—No. 10.—With reference to Revenue (Forest) Department Notifications Nos. 90 and 92, dated the 7th June 1916, Mr. J. L. Hefferman, Extra Deputy Conservator of Forests, reported himself for duty in the Katha Division on the forenoon of the 30th June 1916 and took over charge from Mr. F. E. C. Palmer, Extra Assistant Conservator of Forests, on the afternoon of the 1st July 1916.

No. 113.—Under the provisions of Article 260 of the Civil Service Regulations, privilege leave for six weeks is granted to Mr. A. E. Eden, Assistant Conservator of Forests, on duty in the Thaungyin Forest Division, with effect from the 12th June 1916, or the subsequent date on which he may avail himself of it.

No. 114.—On transfer from the Andamans, Mr. C. E. Parkinson, Extra Assistant Conservator of Forests, is attached to the Thaungyin Forest Division.

5th July 1915.—No. 11.—With reference to Revenue (Forest) Department Notification No. 112, dated the 29th June 1916, Mr. G. S. Shirley, Deputy Conservator of Forests, assumed charge of his duties in the Mandalay Forest Division on the forenoon of the 22nd June 1916.

No. 12.—With reference to Revenue (Forest) Department Notifications Nos. 100 and 104, dated the 15th June 1916, Mr. H. W. A. Watson, Deputy Conservator of Forests, made over, and Mr. A. P. Davis, Deputy Conservator of Forests, received charge of the Ruby Mines Forest Division on the afternoon of 1st July 1916.

No. 22.—With reference to Revenue (Forest) Department Notification No. 77, dated the 17th May 1916, Mr. H. R. Meredith, Deputy Conservator of Forests, relinquished charge of the duties of the Personal Assistant to the Conservator of Forests, Pegu Circle, on the afternoon of the 9th May 1916, and availed himself of the combined leave granted him from the forenoon of the following date.

No. 23.—With reference to Revenue (Forest) Department Notification No. 78, dated the 5th May 1916, Mr. J. C. Hopwood, Deputy Conservator of Forests, assumed charge of the duties of the Personal Assistant to the Conservator of Forests, Pegu Circle, on the forenoon of the 5th June 1916.

6th July 1916.—No. 11.—With reference to Revenue (Forest) Department Notification No. 112, dated the 29th June 1916, Mr. G. S. Shirley, Deputy Conservator of Forests, made over charge of his duties in the Katha Division on the forenoon of the 24th June 1916.

No. 115.—Mr. R. Unwin, Assistant Conservator of Forests, is transferred from the Pyinmana Forest Division and is posted to the South Toungoo Forest Division for special duty in connection with measuring timber at Toungoo.

7th July 1916.—No. 24.—With reference to Revenue (Forest) Department Notification No. 101, dated the 15th June 1916, Mr. C. H. Philipp, Deputy Conservator of Forests, made over, and Mr. W. A. Robertson, Deputy Conservator of Forests, received charge of the Zigôn Forest Division, in addition to his own duties, on the forenoon of the 3rd July 1916. From the same date Mr. Philipp availed himself of the combined leave for eight months granted to him in Revenue (Forest) Department Notification No. 99, dated the 15th June 1916.

11th July 1916.—No. 17.—With reference to Revenue (Forest) Department Notification No. 113, dated the 3rd July 1916, Mr. A. E. Eden, Assistant Conservator of Forests, availed himself of the six weeks' privilege leave granted to him therein with effect from the forenoon of the 12th June 1916.

12th July 1916.—No. 18.—With reference to Revenue (Forest) Department Notification No. 81, dated the 19th May 1916, Mr. D. H. M. Silvanus, Deputy Conservator of Forests, availed himself of the one month's privilege leave granted him therein with effect from the forenoon of the 3rd July 1916.

No. 121.—Mr. R. R. O'Hara, Extra Deputy Conservator of Forests, attached to the Arakan Forest Division, is placed in charge of the Kyaukpyu Sub-division of that division in place of Mr. J. D. Hamilton, Extra Assistant Conservator of Forests, who remains attached to the division.

No. 122.—Under the provisions of Articles 260, 233 and 336 of the Civil Service Regulations, privilege leave for three months combined with leave on medical certificate for three months in continuation thereof is granted to Mr. J. D. Hamilton, Extra Assistant Conservator of Forests, attached to the Arakan Forest Division, with effect from the 24th May 1916.

No. 123.—Mr. H. S. Ker Edie, officiating Conservator of Forests, made over, and Mr. R. C. Milward, officiating Conservator of Forests, received charge of the office of Conservator of Forests, Tenasserim Circle, on the 5th July 1916, forenoon.

20th July 1916.—No. 19.—With reference to Revenue (Forest) Department Notification No. 120, dated the 6th July 1916, Mr. W. C. Rooke, Probationary Extra Assistant Conservator of Forests, relinquished his duties in the North Toungoo Forest Division on the afternoon of the 12th July 1916.

No. 124.—On return from leave Mr. W. S. Powell, Deputy Conservator of Forests, was reposted to the charge of the Thaungyin Forest Division, in place of Mr. R. L. Pocock, Extra Deputy Conservator of Forests, who remains in charge of the Ataran Forest Division.

21st July 1916.—No. 125.—Under the provisions of Article 260 of the Civil Service Regulations, Mr. J. W. Bradley, Deputy Conservator of Forests, is granted an extension of privilege leave for two days in continuation of the leave granted in this Department Notification No. 56 of the 11th April 1916.

TIMBER AND PRODUCE RATES

C. LEARY & CO.'S LONDON MARKET REPORT.

1st to 30th June 1916.

EAST INDIA TEAK.—*Timber*.—The enquiry is rather dull, but values continue firm. *Planks*.—The demand shows some improvement, but prices are unchanged. Quotations are : Timber, £16 to £30 (Java, £12 to £22) ; Flitches, £20 to £30 (Hewn Java, £15 to £23) ; Planks, £17 to £30 (Java, £15 to £22) ; all at per load on c.i.f. terms. The analysis of deliveries and stocks is as follows :—

Deliveries for June. Loads.		Deliveries to 30th June. Loads.		Dock Stock. Loads.	
<i>Timber.</i>	<i>Planks.</i>	<i>Timber.</i>	<i>Planks.</i>	<i>Timber.</i>	<i>Planks.</i>
1916 ... 112	254	960	1,383	1,475	4,104
1915 ... 72	235	2,311	1,340	1,861	3,540
1914 ... 206	344	1,330	2,187	2,453	2,824

PADOUK.—A small parcel just arrived has gone direct into consumption. There is a favourable outlet for further quantities.

SATINWOOD.—East India.—Some further sales have been made from landed stocks, which are however still sufficient.

* ROSEWOOD.—East India—is extremely slow of sale.

* EBONY.—Ceylon and East India.—The demand is negligible.

* The import of these woods is prohibited except under licence.

QUOTATIONS FOR FOREST PRODUCTS.

Name of Products.	Market for which quoted.	Latest prices received.	Per	Average rates for period from June to August 1916.	Per	REMARKS.
Agar Wood	London ...	Not available.	md.	Rs. 40 to Rs. 66-5-4	md.	According to quality.
Bees-wax	Calcutta ...	Rs. 40 to Rs. 67	cwt.	Not available.		
yellow	London ...	†£6 to £8 15s.	ton	"		
Boxwood	" "	†£9 to £12	lb.	"		
Cardamoms	" "	†15s. 7d. to 5s. 10d.	cwt.	"		
Croton Seed	" "	†42s. 6d. to 47s. 6d.	"	Rs. 49-13-4 to Rs. 62-5-4	cwt.	
Cutch (Tablet)	Rangoon ...	Rs. 42 to Rs. 62	"	Rs. 57-8 to Rs. 61-8	"	
(Block)	" "	Rs. 53 to Rs. 62	"	Rs. 38-5-4 to Rs. 53	"	
(Basket)	" "	Rs. 35 to Rs. 37	"			
"	London ...	Not quoted.				
Ebony	" "	"				
Elephant Tusks—						
50 lbs. and upwards	London ...	†£65 to £71	cwt.	*£65 to £71 3s. 4d.	cwt.	
Fibres and Flosses—						
Coir	Calcutta ...	Rs. 5 to Rs. 6	md.	Rs. 5 to Rs. 5-14-8	md.	In bales of 200 lbs.
Kapok (Floss)	" "	Rs. 20-4 to Rs. 21-8	"	Rs. 19-6-8 to Rs. 21-4	"	
(Fibre)	London ...	††9d. to 11d.	lb.	**8½d. to 11d.	lb.	
Kitool	" "	††1d. to 11d.	"	**1d. to 11d.	"	
Palmira	" "	†£25 to £45	ton	*£25 to £46 6s. 8d.	ton	
Rhea or China grass	" "	††£42 to £49	"	**£42 to £48 6s. 8d.	"	
Gum Arabic	Bombay ...	Re. 1	lb.	Not available.		
Karachi	London ...	†25s. to 35s.	cwt.	"		
Madras	" "	†20s. to 32s. 6d.	"	"		
Kino	Bombay ...	Re. 1-8	lb.	"		
"	London ...	Not quoted.				
Catechu	Bombay ...	† Re. 1	lb.	Not available.		

Name of Products.	Market for which quoted.	Latest prices received.	Per	Average rates for period from June to August 1916.	Per	REMARKS.
Rosin, "F" grade ...	Bombay ...	Rs. 13-14-7 to Rs. 14-4-5	md.	Rs. 14-0-11 to Rs. 14-8-4	md.	(barrel of 4 to 5 cwt.) } Ex. wharf, less 2½ % disc. and Tare 20 %. According to quality, unassorted.
" " "G" grade ...	Calcutta ...	Rs. 90 to Rs. 98	barrel	Rs. 90 to Rs. 96-6-8	barrel	
" " Common strained ...	London ...	†Rs. 11-8-6	md.	*Rs. 11-8-6 to Rs. 11-9-11	md.	
" " "G" grade ...	Calcutta ...	Rs. 14-10-3 to Rs. 16-1-8	"	Rs. 14-10-3 to Rs. 15-10-10	"	
" " "G" grade ...	London ...	†Rs. 11-15	"	*Rs. 11-13-6 to Rs. 11-15-9	"	
" " "H" grade ...	"	†Rs. 12-1-3	"	*Rs. 12-1-3 to Rs. 12-2-8	"	
" " "H" grade ...	"	Rs. 20 to Rs. 55	"	Rs. 20 to Rs. 56-10-8	"	
Rubber, India ...	Calcutta ...		"		"	
" " Assam ...	London ...	†1s. 7d.	lb.	Not available.		
" " Burma ...	"	†1s. 8d.	"	"		
" " Para ...	"	†2s. 8d. to 2s. 8½d.	"	"		
Senna (Tinnevely) ...	"	†6½d. to 1s. 1½d.	lb.	"		
Shellac, T.N. in Diamond ...	Calcutta ...	Rs. 59 to Rs. 68	md.	Rs. 48-10-8 to Rs. 58-5-4	md.	
" " T.N. " " ...	London ...	††92s. 6d.	cwt.	Not available.		
" " T.N. in Orange ...	"	†95s. to 130s.	"	"		
" " A.C. in Garnet... ...	"	†87s. to 92s.	"	*87s. 2d. to 90s. 4d.	cwt.	
" " A.C. ...	Calcutta ...	Rs. 62	md.	Rs. 46-10-8 to Rs. 49-10-8	md.	
Sleepers, Chir—						
" " 12' ...	Jagadhari	Rs. 50 to Rs. 62	score	Rs. 56 to Rs. 62-5-4	score	
" " 11' ...	"	Rs. 48 to Rs. 52	"	Rs. 48 to Rs. 52-5-4	"	
" " 8' ...	"	Rs. 30 to Rs. 36	"	Rs. 31-10-8 to Rs. 35-10-8	"	
" " 6' ...	"	Rs. 18 to Rs. 24	"	Rs. 19-5-4 to Rs. 23	"	
Scantlings 11' ...	"	Rs. 20 to Rs. 24-8	"	Rs. 20-5-4 to Rs. 23-5-4	"	
Tamarinds—						
Madras ...	London ...	†25s. to 26s.	cwt.	Not available.		
Calcutta ...	"	Rs. 1-14 to Rs. 4-8	md.	Re. 1-14 to Rs. 4-8-8	md.	According to quality and quantity. Ton = to 50 c.ft.
Indian ...	Calcutta ...					
Teak (selected Indian, 1st class) ...	"	Rs. 160	ton	Rs. 155 to Rs. 158-5-4	ton	

Turpentine—		London ...		†Rs. 2-4-2 to Rs. 2-6-10		*Rs. 2-3-5 to Rs. 2-7-9	
" American Spirit Spot	...	Calcutta ...	...	} Not quoted.			gal.
" Weight Brand ...	...	"	...	Re. 1-14 to Rs. 2-4		Re. 1-12-8 to Rs. 2-4	gal.
" Hand "	...	"	...	Rs. 4-12 to Rs. 5-4		Rs. 4-8-4 to Rs. 5	"
" Substitute ...	...	"	...	Rs. 4-9-7 to Rs. 4-12-10		Rs. 4-10-11 to Rs. 4-13-1	"
" Hubbuck's Genuine	...	"	...	Rs. 4-8 to Rs. 4-10		Rs. 4-9-8 to Rs. 4-11-7	"
" Blundell & Spence ...	...	Bombay	...	Rs. 5		Not available.	"
" Wilkinson Heywood & Clerk	...	"	...				
" Standard Oil	...	"	...				

NOTE.—† Represents rates for July 1916.

* Represents average rates for the period from May to July 1916.

†† Represents rates for June 1916.

** Represents average rates for the period from April to June 1916.

Md. Indicates Bengal Maund which is equal to 82 lbs.

All prices shown in column No. 3 represent the highest and lowest prices recorded up to the 26th August 1916.

All prices shown in column No. 5 represent the average rates for three months' prices, recorded up to the 26th August 1916.

All prices, not cross-marked in the third column, are the market rates for August 1916.

DEHRA DUN, U. P. : }
Dated 1st September 1916. }

(Sd.) R. S. PEARSON,
Forest Economist.

LIST OF BOOKS AND PUBLICATIONS RECEIVED
BY THE HONORARY EDITOR DURING
THE MONTH OF JULY 1916.

- The Scottish Geographical Magazine, Vol. XXXII, No. 6, of June 1916.
- Indian Engineering, Vol. LX, Nos. 1, 2, 3, 4 and 5 for 1st, 8th, 15th, 22nd and 29th July 1916, with supplement for the last number.
- Administration Report of the Forest Circles in the Bombay Presidency (including Sind) for the year 1914-15.
- Tree Planting—Forestry Department, State of Maine, 1916.
- Handling the Farm Woodlot—University of Maine, Agricultural Extension Service, Bulletin No. 105, 1916.
- Ceylon Forest Administration Report, 1915.
- Monthly Bulletin of Agricultural Intelligence and Plant Diseases, No. 2, February 1916.
- Journal of the Board of Agriculture, Vol. XXIII, No. 3, of June 1916.
- Studies in the Chemistry and Physiology of the Leaves of the Betel Vine (*Piper Betle*) and of the Commercial Bleaching of Betel-Vine Leaves, Part II—Memoirs of the Department of Agriculture, Chemical Series, Vol. IV, No. 7, of June 1916.
- India Rubber World, Vol. LIV, No. 3, of 1st June 1916.
- Agriculture in India, by James Mackanna, M.A., I.C.S., published in 1915.
- Commercial America, Vol. XII, No. 12, of June 1916.
- Bulletin Economique De L'Indochine, No. 117, of January-February 1916.
- The Indian and Eastern Engineer, New Series, Vol. XXXIX, No. 1, for July 1916.
- Annual Report of the Department of Land Records in the Bombay Presidency including Sind for the year 1914-15.
- American Forestry, Vol. 22, No. 270, for June 1916.
- Records of the Geological Survey of India, Vol. XLVII, Part 2, of 1916.

GAZETTE NOTIFICATIONS.

1.—GAZETTE OF INDIA.

28th July 1916.—No. 464-F.-315-6.—Mr. R. C. Milward, Deputy Conservator of Forests, United Provinces, on reversion from the Indian Army Reserve of Officers, is appointed to officiate as Conservator of Forests, 3rd grade, in charge of the Tenasserim Circle, Burma, with effect from the 5th July 1916, forenoon.

From the same date Mr. H. S. Ker-Edie, officiating Conservator, 3rd grade, reverted to the class of Deputy Conservators.

4th August 1916.—No. 599-219-2.—Rai Sahib Nand Mal, Extra Deputy Conservator of Forests, in charge of Forest Publications, at the Forest Research Institute and College, Dehra Dun, is granted privilege leave for two months with effect from the 10th August 1916, or the subsequent date on which he may avail himself of it.

7th August 1916.—No. 606-205-3.—Mr. R. E. Marsden, Deputy Conservator of Forests, and Sylviculturist at the Forest Research Institute and College, Dehra Dun, is granted privilege leave for five weeks with effect from the 10th August 1916, or the subsequent date on which he may avail himself of it.

Mr. B. B. Osmaston, President, Forest Research Institute and College, is appointed to hold charge of the office of Sylviculturist, in addition to his own duties, during the absence of Mr. Marsden on leave.

2.—BENGAL GAZETTE.

8th August 1916.—No. 6367-For.—Babu Sachindra Nath Mitra, B.Sc., having passed the final examination of the Provincial Forest Service Course at the Forest Research Institute, Dehra Dun, is appointed to be a Probationary Extra Assistant Conservator of Forests, Bengal, with effect from the 23rd July 1916.

9th August 1916.—No. 13-For.—On his return from privilege leave Babu Gurudas Chatarji, Extra Assistant Conservator of Forests, is re-posted to the charge of the Cobaduk Revenue Station in the Sundarbans Forest Division.

3.—BIHAR AND ORISSA GAZETTE.

12th August 1916.—No. 4.—On being relieved of the charge of the Palamau Forest Division by Mr. R. G. A. Hannah, Mr. W. G. C. Breakey, Extra Assistant Conservator of Forests, is transferred to the Singbhum Forest Division as an attached officer, with head-quarters at Chaibassa.

4.—ASSAM GAZETTE.

21st August 1916.—No. 2839-R.—The following officers are appointed Probationary Extra Assistant Conservators of Forests on a salary of Rs. 150 each per mensem, with effect from the 8th July 1916, and are attached to the Forest Divisions noted below :—

- | | | |
|---------------------------------|-----|----------------------------|
| 1. Babu Rajendra Nath De | ... | Lakhimpur Forest Division. |
| 2. Babu Anil Kumar Adhikari | ... | Sibsagar ditto. |
| 3. Srijut Troilokesvar Hazarika | ... | Cachar ditto. |

5.—UNITED PROVINCES GAZETTE.

29th July 1916.—No. 35.—Mr. W. C. Monro, Probationary Extra Assistant Conservator of Forests, attached to East Almora Division, Kumaun Circle, is granted one month's privilege leave, with effect from the 1st August 1916, or any subsequent date that he avails himself of it.

8th August 1916.—No. 36.—Pandit Shambhu Dat Joshi, Extra Assistant Conservator of Forests, on deputation to the Benares State, was granted three months' privilege leave by the Benares Darbar, with effect from the 8th May 1916.

16th August 1916.—No. 37.—Shaikh Rahmat-ullah, Extra Assistant Conservator of Forests, attached to West Almora Division, Kumaun Circle, privilege leave for one month and a half, with effect from the date he avails himself of it.

No. 38.—Mr. H. W. Moor, Probationary Extra Assistant Conservator of Forests, attached to Afforestation Division, Eastern Circle, privilege leave for two months, with effect from the 1st September 1916.

No. 39.—Mian Muhammad Zia-ul Haq, Probationary Extra Assistant Conservator of Forests, attached to North Kheri Division, Eastern Circle, privilege leave for one month, with effect from the 1st September 1916, or the subsequent date on which he may avail himself of it.

22nd August 1916.—No. 40.—Pandit Bhowani Dat Pant, Extra Assistant Conservator of Forests, attached to East Almora Division, Kumaun Circle, is transferred to the West Almora Division in the same Circle as an attached officer.

6.—PUNJAB GAZETTE.

10th August 1916.—No. 257.—Consequent on the retirement of Lala Sundar Das, Extra Assistant Conservator of Forests, the following promotion is made, with effect from 16th May 1916 :—

Mian Lekh Chand, Probationary Extra Assistant Conservator of Forests, to be Extra Assistant Conservator of Forests, permanent substantive.

14th August 1916.—No. 260.—Mian Budhi Singh, Extra Assistant Conservator of Forests, and Malik Allah Yar Khan, Probationary Extra Assistant Conservator of Forests, respectively, made over and received charge of the Montgomery Forest Division on the afternoon of the 31st July 1916, consequent on the former's departure on three months' privilege leave.

7.—CENTRAL PROVINCES GAZETTE.

2nd August 1916.—No. 63.—Privilege leave for two months, under Article 242 (a) of the Civil Service Regulations, is granted to Mr. Saiyed Muhammad Ibrahim Aidroos, Probationary Extra Assistant Conservator of Forests, in charge of the Chandgarh Range, Nimar Division, with effect from the date he is relieved of his duties.

16th August 1916.—No. 1676.—Privilege leave for one month, under Article 260 of the Civil Service Regulations, is granted to Mr. H. C. B. Jollye, Assistant Conservator of Forests, in charge of the Seoni Forest Division, with effect from the 15th August 1916, or the subsequent date on which he may avail himself of it.

No. 1677.—Mr. H. S. George, Assistant Conservator of Forests, attached to the Conservator's Office, Northern Circle, is appointed to the charge of the Seoni Forest Division during the absence on leave of Mr. Jollye, or until further orders.

22nd August 1916.—No. 1708.—On relief by Mr. B. Inamati Sham Rao, on return from privilege leave, Mr. Pandurang Narayan, Extra Assistant Conservator of Forests, in charge of the Akola Division, is re-transferred to the Melghat Division as an attached officer.

24th August 1916.—No. 1732.—Privilege leave for sixteen days, under Article 260 of the Civil Service Regulations, is granted to Mr. V. G. Morgan, Deputy Conservator of Forests, in charge of the Buldana Forest Division, with effect from the 4th September 1916, or the subsequent date on which he may avail himself of it.

No. 1733.—Mr. B. Inamati Sham Rao, Extra Assistant Conservator of Forests, in charge of the Akola Forest Division, is appointed to the charge of the Buldana Forest Division, in addition to his own duties, during the absence of Mr. Morgan on leave, or until further orders.

8.—MADRAS GAZETTE.

28th July 1916.—No. 359.—The following Forest Officers are granted privilege leave for the period noted against each, under Article 260 of the Civil Service Regulations :—

(1) Mr. T. Clear, District Forest Officer, West Kurnool, for six weeks from 14th July 1916.

(2) Mr. G. W. Thompson, District Forest Officer, South Kurnool, for six weeks after the return of Mr. T. Clear.

This cancels Notification 269, dated 17th June 1916.

1st August 1916.—M. R. Ry. E. V. Padmanabha Pillai Avargal, Probationary Extra Assistant Conservator of Forests, on relief of the charge of West Cuddapah Division, is posted to do duty under the Conservator of Forests, Central Circle, in connection with the preparation of Working Plans in Bellary District.

3rd August 1916.—Under Article 260 of the Civil Service Regulations, the Board grants privilege leave for twenty-one days with effect from 14th July 1916 to Mr. T. N. Hearsey, Extra Assistant Conservator of Forests, on special duty.

7th August 1916.—M. R. Ry. P. Venkataramanan, Extra Assistant Conservator of Forests, working under the District Forest Officer, Vellore South, is posted to the Northern Circle, to work under the District Forest Officer, Ganjam. To join forthwith.

15th August 1916.—No. 395.—Under Article 237 (c) of the Civil Service Regulations, Mr. J. S. Scot, Deputy Conservator of Forests, is granted extension of furlough for four days, *i.e.*, from the 6th to the 9th July 1916.

9.—BOMBAY GAZETTE.

2nd August 1916.—No. 941.—Mr. W. F. D. Fisher, Acting Conservator of Forests, Northern Circle, received charge of the offices of the Divisional and Sub-divisional Forest Officers, South Nasik, from Mr. D. R. S. Bourke, Deputy Conservator of Forests, on the afternoon of 25th July 1916.

Mr. L. S. Koppikar, Extra Assistant Conservator of Forests and Personal Assistant to Conservator of Forests, Northern Circle, having been transferred as Sub-divisional Forest Officer, South Nasik, was relieved of his duties in the Conservator's office on the 27th July 1916 in the forenoon and received charge of his new duties from Mr. W. F. D. Fisher, Acting Conservator of Forests, Northern Circle, at the same time.

10th August 1916.—No. 984.—Mr. R. P. Dalley, Assistant Conservator of Forests, delivered over and Mr. R. V. Pethe, Extra Assistant Conservator of Forests, received charge of the office of the Divisional Forest Officer, East Khandesh, on the 2nd August 1916 in the afternoon.

No. 1035.—Mr. W. C. Milne, Assistant Conservator of Forests, delivered over and Mr. B. J. Patel, Extra Assistant Conservator of Forests, received charge of the offices of the Sub-divisional and Divisional Forest Officers, Panch Mahals, respectively on the fore and afternoon of 27th July 1916.

18th August 1916.—No. 8108.—Mr. Vishnu Ganesh Bhallerav, Extra Assistant Conservator of Forests and Sub-divisional Forest Officer, Central Thana, is granted privilege leave of absence for three months with effect from the date of relief.

10.—BURMA GAZETTE.

18th July 1916.—No. 14.—With reference to Revenue (Forest) Department Notification No. 92, dated the 7th June 1916, Mr. F. E. C. Palmer, Extra Assistant Conservator of Forests, assumed charge of his duties in the Mandalay Forest Division on the forenoon of the 6th July 1916.

19th July 1916.—No. 25.—With reference to Revenue (Forest) Department Notifications Nos. 100 and 101, dated the 15th June 1916, Messrs. W. A. Robertson and H. W. A. Watson, Deputy Conservators of Forests, respectively made over and received charge of the Zigôn Forest Division on the afternoon of the 11th July 1916.

20th July 1916.—No. 20.—With reference to Revenue (Forest) Department Notification No. 119, dated the 6th July 1916, Mr. D. J. Monro, Extra Assistant Conservator of Forests, availed himself of the three months' privilege leave granted him therein with effect from the afternoon of the 18th July 1916.

22nd July 1916.—No. 21.—With reference to Revenue (Forest) Department Notification No. 120, dated the 6th July 1916, Mr. W. C. Rooke, Probationary Extra Assistant Conservator of Forests, reported his arrival at the Divisional Forest Office, Pegu, on the forenoon of the 17th and assumed charge of his duties on the afternoon of the 18th July 1916.

No. 26.—With reference to Revenue (Forest) Department Notification No. 102, dated the 15th June 1916, Messrs. J. J. Rorie and W. A. Robertson, Deputy Conservators of Forests, respectively made over and received charge of the Insein Forest Division on the afternoon of the 18th July 1916.

24th July 1916.—No. 126.—Mr. A. S. Rencontre, Extra Assistant Conservator of Forests, is permitted to retire from the service of Government with effect from the 6th June 1916.

25th July 1916.—No. 127.—Mr. W. Lawton, Deputy Conservator of Forests, attached to the Ruby Mines Forest Division, is transferred from Mogok and is posted to the charge of the Pegu Forest Division, in place of Mr. J. M. D. Mackenzie, Assistant Conservator of Forests, transferred.

No. 128.—On relief by Mr. W. Lawton, Deputy Conservator of Forests, Mr. J. M. D. Mackenzie, Assistant Conservator of Forests, in charge of the Pegu Forest Division, is transferred from Pegu and is attached to the Prome Forest Division.

No. 22.—With reference to Revenue (Forest) Department Notification No. 124, dated the 20th July 1916, Mr. R. L. Pocock, Extra Deputy Conservator of Forests, made over, and Mr. W. S. Powell, Deputy Conservator of Forests, received, charge of the Thaungyin Forest Division on the forenoon of the 4th July 1916.

29th July 1916.—No. 23.—With reference to Revenue (Forest) Department Notification No. 114, dated the 3rd July 1916, Mr. C. E. Parkinson, Extra Assistant Conservator of Forests, assumed charge of his duties in the Thaungyin Forest Division on the forenoon of 26th July 1916.

31st July 1916.—No. 15.—With reference to Revenue (Forest) Department Notification No. 103, dated the 15th June 1916, Mr. A. P. Davis, Deputy Conservator of Forests, made over, and Mr. J. J. Rorie, Deputy Conservator of Forests, received, charge of the Ruby Mines Forest Division on the forenoon of the 28th July 1916.

Mr. A. P. Davis remains attached to the Ruby Mines Division on Working Plans duty.

No. 129.—Mr. F. Linnell, Deputy Conservator of Forests, on leave, is permitted to retire from the service of Government with effect from the 12th August 1916.

No. 130.—Under the provisions of Article 260 of the Civil Service Regulations, privilege leave for three months is granted to Maung Po Kyu, Extra Assistant Conservator of Forests, attached to the Ruby Mines Forest Division, with effect from the 15th August 1916, or the subsequent date on which he may avail himself of it.

2nd August 1916.—No. 16.—With reference to Revenue (Forest) Department Notification No. 127, dated the 25th July 1916, Mr. W. Lawton, Deputy Conservator of Forests, relinquished charge of his duties in the Ruby Mines Forest Division on the afternoon of the 24th July 1916.

3rd August 1916.—No. 132.—Maung Po Kyu, Extra Assistant Conservator of Forests, on probation, is confirmed in his appointment in the Provincial Forest Service with effect from the 1st August 1916.

No. 133.—Maung San E, Extra Assistant Conservator of Forests, on probation, is confirmed in his appointment in the Provincial Forest Service with effect from the 1st August 1916.

7th August 1916.—No. 24.—With reference to Revenue (Forest) Department Notification No. 127, dated the 25th July 1916, Mr. J. M. D. Mackenzie, Assistant Conservator of Forests, made over, and Mr. W. Lawton, Deputy Conservator of Forests, received charge of the Pegu Forest Division on the forenoon of the 1st August 1916.

10th August 1916.—No. 136.—Mr. E. F. A. Hay, Assistant Conservator of Forests, in charge of the Gangaw Sub-division of the Yaw Forest Division, is transferred from Gangaw and is placed on special duty in the office of the Chief Conservator of Forests, Burma.

12th August 1916.—No. 25.—With reference to Revenue (Forest) Department Notification No. 115, dated the 6th July 1916, Mr. R. Unwin, B.Sc., Assistant Conservator of Forests, assumed charge of his special duty in connection with timber measuring at Toungoo on the forenoon of the 8th August 1916.

14th August 1916.—No. 137.—Mr. A. R. Villar, Deputy Conservator of Forests, is transferred from the Shwegu Sub-division of the Bhamo Forest Division and is posted to the Yaw Forest Division for special duty in connection with measuring timber at Pakokku.

No. 138.—Mr. E. W. Carroll, Assistant Conservator of Forests, is transferred from the Pinyin Forest Division and is posted to the Yaw Forest Division for special duty in connection with measuring timber at Pakokku.

No. 139.—Mr. H. C. Smith, Assistant Conservator of Forests, is transferred from the Ruby Mines Forest Division and is posted to the Yaw Forest Division for special duty in connection with measuring timber at Pakokku.

No. 140.—Mr. G. S. Shirley, Deputy Conservator of Forests, is transferred from the Mandalay Forest Division and is posted to the Mandalay Dépôt Forest Division for special duty in connection with measuring timber at Mandalay.

No. 141.—Mr. J. W. Bradley, Deputy Conservator of Forests, attached to the Prome Forest Division, is transferred from Prome and is posted to the charge of the South Tenasserim Forest Division in place of Mr. A. B. Nixon, Deputy Conservator of Forests, transferred.

15th August 1916.—No. 142.—On relief by Mr. J. W. Bradley, Deputy Conservator of Forests, Mr. A. B. Nixon, Deputy Conservator of Forests, in charge of the South Tenasserim Forest Division, is transferred from Tavoy and is attached to the Katha Forest Division.

16th August 1916.—No. 142.—Under the provisions of Article 260 of the Civil Service Regulations, privilege leave for two months is granted to Mr. F. G. Edwards, Probationary Extra Assistant Conservator of Forests, attached to the Mu Forest Division with effect from the date on which he avails himself of it.

17th August 1916.—No. 144.—On return from leave Maung San E, Extra Assistant Conservator of Forests, is posted to the charge of the Revenue Range, North Toungoo Forest Division, in place of Mr. W. R. French, Extra Deputy Conservator of Forests, transferred.

No. 145.—On relief by Maung San E, Extra Assistant Conservator of Forests, Mr. W. R. French, Extra Deputy Conservator of Forests, in charge of the Revenue Range, North Toungoo Forest Division, is transferred from Toungoo and is attached to the South Tenasserim Forest Division.

TIMBER AND PRODUCE RATES.

C. LEARY & CO.'S LONDON MARKET REPORT.

1st to 31st July, 1916.

EAST INDIA TEAK.—*Timber*.—The position shows no improvement, although values are unaltered. *Planks*.—The demand has been very quiet. Quotations are: Timber, £16 to £30 (Java, £12 to £22); Flitches, £20 to £30 (Hewn Java, £15 to £23); Planks, £17 to £30 (Java, £15 to £22); all at per load on c.i.f. terms. The analysis of deliveries and stocks is as follows:—

	Deliveries for July.		Deliveries to 31st July.		Dock Stock.	
	Loads.		Loads.		Loads.	
	<i>Timber.</i>	<i>Planks.</i>	<i>Timber.</i>	<i>Planks.</i>	<i>Timber.</i>	<i>Planks.</i>
1916	93	157	1,053	1,540	2,316	4,279
1915	37	262	2,348	1,602	2,001	3,336
1914	167	292	1,497	2,479	2,337	2,823

PADOUK.—High prices would be paid, but it is extremely difficult to secure supplies.

*SATINWOOD.—East India.—The demand is very limited.

*ROSEWOOD.—East India.—The available supplies are sufficient for present requirements.

*EBONY.—Ceylon, East India.—Limited shipments of good character would be well received.

* The imports of these woods is prohibited except under license.

QUOTATIONS FOR FOREST PRODUCTS.

Name of Products.	Market for which quoted.	Latest prices received.	Per	Average rates for period from July to September 1916.	Per	REMARKS.
Agar Wood	London ...	Not available.	md.	Rs. 40 to Rs. 67-10-8	md.	According to quality.
Bees-wax	Calcutta ...	Rs. 40 to Rs. 70	cwt.	Not available.		
" yellow	London ...	†£6 to £8 15s.	ton	"		
Boxwood	" "	††£9 to £12	lb.	"		
Cardamoms	" "	†15s. 7d. to 5s. 10d.	cwt.	"		
Croton Seed	" "	†42s. 6d. to 47s. 6d.	"	Rs. 47-2-8 to Rs. 64	cwt.	1st quality.
Cutch (Tablet)	Rangoon ...	Rs. 42 to Rs. 70	"	Rs. 62-10-8 to Rs. 66-8	"	"
" (Block)	" "	Rs. 72-8 to Rs. 75	"	Rs. 37-5-4 to Rs. 59	"	
" (Basket)	" "	Rs. 35 to Rs. 38	"			
" "	London ...	Not quoted.				
Ebony	" "	"				
Elephant Tusks—						
50 lbs. and upwards	London ...	†£65 to £71 10s.	cwt.	*£65 to £71-3-4	cwt.	
Fibres and Flosses—						
Coir	Calcutta ...	Rs. 5 to Rs. 6	md.	Rs. 5 to Rs. 6	md.	In bales of 200 lbs.
Kapok (Floss)	" "	Rs. 20-4 to Rs. 21-8	"	Rs. 20-2-8 to Rs. 21-10-8	"	"
" (Fibre)	London ...	††6½d. to 12d.	lb.	**8½d. to 11½d.	lb.	165 lbs.
Kitool	" "	†11d. to 11d.	"	**1d. to 11d.	"	
Palmira	" "	†£25 to £45	ton	*£25 to £45	ton	
Rhea or China grass	" "	††£42 to £49	lb.	**£42 to £48	"	
Gum Arabic	Bombay ...	Re. 1	lb.	Not available.		
" Karachi	London ...	†25s. to 35s.	cwt.	"		
" Madras	" "	†20s. to 32s. 6d.	"	"		
" Kino	Bombay ...	Re. 1-8	lb.	"		
" "	London ...	Not quoted.	"	"		
" Catechu	Bombay ...	† Re. 1	"	"		

Turpentine—			
American Spirit Spot	London	†Rs. 2-6-2 to Rs. 2-7-8	gal.
Weight Brand	Calcutta	Not quoted.	
Hand	"	Rs. 2-2 to Rs. 2-4	gal.
Substitute	"	Rs. 5 to Rs. 5-2	"
Hubbuck's Genuine	"	Rs. 4-6-7 to Rs. 4-11-2	"
Blundell & Spence	Bombay	Rs. 4-6-5 to Rs. 4-9-7	"
Wilkinson Heywood & Clerk	"	Rs. 5	"
Standard Oil	"		"
Wood Pulp—			
Chemical	London	†£34 to £50	ton
Mechanical (moist)	"	†£4-5s. to £4-10s.	"
dry,	"	†£10	"
		Not available.	
		"	
		"	

NOTE.—† Represents rates for August 1916.

* Represents average rates for the period from June to August 1916.

†† Represents average rates for July 1916.

** Represents average rates for the period from May to July 1916.

Md. Indicates Bengal Maund which is equal to 82 lbs.

All prices shown in column No. 3 represent the highest and lowest prices recorded up to the 23rd September 1916.

All prices shown in column No. 5 represent the average rates for three months' prices, recorded up to the 23rd September 1916.

All prices, not cross-marked in the third column, are the market rates for September 1916.

DEHRA DUN, U. P. : }
Dated 1st October 1916. }

(Sd.) R. S. PEARSON,
Forest Economist.

LIST OF BOOKS AND PUBLICATIONS RECEIVED BY THE
HONORARY EDITOR DURING THE MONTH OF
AUGUST 1916.

- Denny, Mott and Dickson, Limited, Wood Market Report, London, 1st July 1916.
Fauna of British India, Rhynchota—Vol. VI, Homoptera: Appendix, by W. L. Distant, March 1916.
Revue des Eaux et Forêts, No. 7, dated 1st July 1916.
Quarterly Journal of Forestry, Vol. X, No. 3 of July 1916.
The Timberman, Vol. XVII, No. 8 of June 1916.
Uses of Prickly Pear—Government of Madras, Revenue Department, G. O. No. 1151, dated 20th May 1916.
Index to Bulletin Bibliographique Hebdomadaire, 1915.
Indian Engineering, Vol. LX, Nos. 6, 7, 8 and 9, for 5th, 12th, 19th and 26th August 1916.
Lewis and Peat's Monthly Prices Current, London, dated 12th July 1916.
The Agricultural Journal of India, *Special Indian Science Congress number* 1916—Agricultural Research Institute, Pusa.
India Rubber World, Vol. LIV, No. 4, dated 1st July 1916.
"Kosmos," No. 1 of July 1914.
The Indian and Eastern Engineer, New Series, Vol. XXXIX, No. 2 for August 1916.
Melaxuma of the Walnut, "*Juglans regia*"—Agricultural Experiment Station, Berkeley, California, Bulletin No. 261 of November 1915.
Citrus Diseases of Florida and Cuba compared with those of California—Agricultural Experiment Station, Berkeley, California, Bulletin No. 262 of 1915.
Size Grades for Ripe Olives—Agricultural Experiment Station, Berkeley, California, Bulletin No. 263 of January 1915.
The Calibration of the Leakage Meter, Fumigation Studies No. 8—Agricultural Experiment Station, Berkeley, California, Bulletin No. 264 of January 1916.
Punjab Forest Manual, Vol. I.
The Tropical Agriculturist, Vol. XLVII, No. 2 of August 1916.
A Note on the Improvement of the Indigenous Methods of Gur and Sugar making in the United Provinces and a Report on the Government Experimental Sugar Factory, Nawabganj, Bareilly District, published in the year 1916.
Monthly Bulletin of Agricultural Intelligence and Plant Diseases, No. 3 of March 1916.
The Forest Flora of New South Wales, Vol. VI, Part 9.

